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DOCTOR ELMER DREW MERRILL, THE NEW DIRECTOR-IN-CHIEF

THE OKEECHOBEE GOURD
JOHN K. SMALL

THE PETRIFIED FORESTS OF ARIZONA
ARTHUR HOLLICK

CONFERENCE NOTES FOR NOVEMBER

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NATHANIEL LORD BRITTON
DIRECTOR-IN-CHIEF OF THE NEW YORK BOTANICAL GARDEN, JULY 1, 1896, TO AUGUST 1, 1929

JOURNAL
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VOL. XXXI JANUARY, 1930 No. 361

THE RESIGNATION OF DOCTOR NATHANIEL LORD BRITTON AS DIRECTOR-IN-CHIEF OF THE NEW YORK BOTANICAL GARDEN

EXTRACT FROM THE MINUTES OF THE SPECIAL MEETING OF THE SCIENTIFIC DIRECTORS HELD IN THE OFFICE OF PRESIDENT HENRY W. DE FOREST, 165 BROADWAY, JULY 8, 1929

The Chairman reported that he had received the following communication from Dr. Britton:

MAY 25, 1929

"To the Scientific Directors of
The New York Botanical Garden:
Gentlemen:

Pursuant to appointment as Director-in-Chief by the Scientific Directors on May 9, 1896, I have now served continuously in that capacity for a little more than thirty-three years. This service I have greatly enjoyed. I have passed my seventieth birthday and desire to have my time free for scientific investigation and attention to my own affairs.

I hereby tender my resignation as Director-in-Chief to take effect at your convenience and that of the Board of Managers.

Yours very sincerely,
(Signed) N. L. BRITTON."

The following resolution was then adopted:

The Scientific Directors of The New York Botanical Garden accept the resignation of Dr. Nathaniel L. Britton as Director-in-Chief of The New York Botanical Garden, to take effect August 1, 1929.

In acquiescing in Dr. Britton's desire to have his time more free for scientific investigations the Scientific Directors desire to

express their deep appreciation of his distinguished public service in planning and developing the Garden through its thirty-three years of uninterrupted growth and leadership among the botanical institutions of this country.

Both personally and officially, we congratulate Dr. Britton on so distinguished a record of service to plant science and to the public parks and gardens of New York City, and we wish to him, with his new freedom from executive responsibility, many more years of successful effort in those fields of research in which he has already made such notable contributions.

It was further moved that,

WHEREAS, Dr. Nathaniel L. Britton, after thirty-three years of continuous and distinguished service as Director-in-Chief, has seen fit to seek relief from the cares and labors of this office, and,

WHEREAS, We, the Scientific Directors, in accepting his resignation, have appropriately expressed our appreciation of his services to the Garden, it is

Resolved, That, as a further expression of our appreciation and regard, we hereby appoint him Director Emeritus.

The following further resolutions were also adopted:

In recognition of the great importance of Dr. Britton's botanical work we recommend the assignment of Associate Curator Percy Wilson to be Dr. Britton's research assistant.

We further recommend that a committee be appointed to draft a record of the services of Dr. Britton to The New York Botanical Garden for publication in the Garden JOURNAL.

Pursuant to the above resolution, the following record was prepared by a committee of the Scientific Directors:

A BRIEF RECORD OF THE SERVICES OF DR. BRITTON TO THE NEW YORK BOTANICAL GARDEN

Having before us the resignation of our Director-in-Chief, Dr. N. L. Britton, we, the Scientific Directors of The New York Botanical Garden, become reminiscent of the services of Dr. Britton, not alone in the inauguration and conduct of the Garden, but in the earlier years, during which public sentiment in this City was being prepared to entertain and develop the idea of such an institution.

The beginning of the Garden may be said to have existed in the early life of the Torrey Botanical Club and the establishment of its home at Columbia College. In the early history of the Club, Dr. and Mrs. Britton were among the most active and influential participants in its activity and development, while the establish-

ment of a home for botany at Columbia College is to be regarded chiefly as the work of Dr. Britton. Taking advantage of his position as Instructor in the Department of Geology in 1879, and with the encouragement of Professor Newberry, he drew from their hiding places in closets and attics huge bundles of unclassified and forgotten botanical collections and organized them into a creditable nucleus for a universal herbarium, which now constitutes an important part of our working collection. This herbarium, steadily enriched by purchase and exchange and through local collections, became the natural meeting place for botanists, and a source of information for others concerning plants and plant products.

Although these operations were carried on for years before the establishment of the Garden was proposed, they should be regarded as the germ of the final undertaking, since the suggestion of a botanical garden was an inevitable outgrowth of the situation thus created. It was not through the first, nor a number of succeeding efforts, that an effective plan took shape. Early suggestions were almost chimerical, and represented a wish rather than a definite hope. Reiterated and cherished through a period of years, these aspirations gradually gave birth to effort, and plans began to be formulated for an active organization.

The execution of these plans required the enlistment of interest and assistance from persons of influence and wealth, and this interest had to be sustained and extended through a long period of disappointments and doubt. This was, perhaps, the period of Dr. Britton's greatest service to the cause. When, at length, this stage of preparatory and initial work was crowned with success, and the formation of the Garden was actually begun, the selection of Dr. Britton in 1896 as Director was a logical step in the procedure. A wiser selection could not have been made, considering the peculiar and oft-repeated difficulties that arose. There were political and legal difficulties, difficulties of harmonizing, engineering difficulties, and those connected with securing competent coöperation, difficulties of control and, above all, difficulties of financing. Could all these difficulties have been adequately visualized in advance, it is possible that neither Dr. Britton nor any other competent person could have been found willing to undertake the task, but fortunately they developed in succession, and in succession they were met and vanquished by a Director who possessed a rare combination of executive and scientific ability, of persistence and patience, and the success of the undertaking became assured.

A peculiarly difficult and ever present burden of the early management was the utter inadequacy of its resources to offer satisfactory compensation for competent service in any of the

departments. So great has been the burden of management under this condition that the success attained is a veritable marvel to look back upon.

However great the future success of the Garden may be, it will have been made possible by these labors that have gone before. However competent, faithful, and successful future directors may be, a part of their reaping must always come from what Dr. Britton has sown.

In view of the above considerations, we desire to place on record our deep sense of appreciation and gratitude for the life that our retiring Director-in-Chief has expended in our service; to express our great admiration for the success that he has achieved in the position that he is relinquishing, and our unbounded satisfaction that he is to continue working among us, pursuing his scientific work while in the full possession of his natural powers and undisturbed by burdens of executive responsibility.

The minutes of the meeting of the Scientific Directors held on July 8, 1929, further record that

It was then moved and carried that Dr. Elmer D. Merrill be appointed Director-in-Chief of The New York Botanical Garden to succeed Dr. Nathaniel L. Britton.

The meeting of the Scientific Directors then adjourned and reported its action to the Board of Managers.

EXTRACT FROM THE MINUTES OF THE SPECIAL MEETING OF THE BOARD OF MANAGERS HELD IN THE OFFICE OF PRESIDENT HENRY W. DE FOREST, 165 BROADWAY, JULY 8, 1929:

The resignation of Dr. N. L. Britton as Secretary of the Board of Managers, received at the meeting of the Board on June 21, 1929, and laid on the table, was accepted, to take effect August 1, 1929.

The Scientific Directors reported their acceptance of the resignation of Dr. Britton as Director-in-Chief, and this action was approved.

On recommendation of the Scientific Directors, Dr. Britton was appointed Director Emeritus, to take effect August 1, 1929, and Associate Curator Percy Wilson was assigned to him as a research assistant in his scientific investigations.

The following resolution setting forth Dr. Britton's invaluable services to the Garden was adopted:

WHEREAS, Nathaniel Lord Britton has tendered his resignation as Director-in-Chief of The New York Botanical Garden and such resignation has been accepted by the Scientific Directors, the Board of Managers of the Garden deem it fitting to review the main facts of its establishment and to recall the distinguished service which Dr. Britton has rendered during the thirty three years in which he has so ably filled the office of Director in-Chief.

The Garden as an organization dates its beginning from 1896, but to bring it into being several years of strenuous promotion were required. The actual need of a modern botanical garden to serve the interests of plant science in the region of New York City was first formally and definitely set forth by Mrs. N. L. Britton at a meeting of the Torrey Botanical Club on October 24, 1888, and as a result of the sentiment which was thus developed a public appeal for support for the idea was printed and circulated by the Club in January, 1889.

No better moment could have been chosen, as at this time the importance of botanical science as fundamental to gardening, horticulture, and agriculture was becoming plainly apparent to every one. In such a setting the movement assumed such speed under the able guidance of Dr. Britton and with the coöperation of other scientists and public-spirited citizens of vision that a charter was obtained from the State Legislature and the corporation was organized in 1891. The selection of an area of 250 acres for a garden was approved by the Commissioners of the Public Parks of New York City in 1895.

The formation of the collections of living plants, specimens, and books was begun in this year and horticultural operations were initiated in the following year.

Scientific work in the herbarium and laboratories was begun in 1899, with the facilities and organization essentially identical with the present features of the Garden. It is not possible to present even in outline the scientific achievements of Dr. Britton and the staff of the Garden in the following thirty years, except to say that these have been of such value as to bring The New York Botanical Garden to the highest rank among such institutions.

In view of these notable accomplishments,

Therefore, Be It Resolved, by the Board of Managers of The New York Botanical Garden that they desire to record their deep appreciation of Dr. Britton's achievements as a botanist, his zeal, wise counsel, and efficient administration, which have been so largely responsible for the remarkable success of the Garden. It is with great satisfaction that we have designated Dr. Britton

as Director Emeritus in order that his name continue to be associated with the institution of which he is so largely the creator.

Mr. H. de la Montagne, Jr., was elected Acting Secretary of the Board of Managers, from August 1, 1929.

The following preamble and resolutions were adopted:

WHEREAS, the Scientific Directors have appointed as Director-in-Chief of The New York Botanical Garden, Dr. Elmer Drew Merrill, it is

Resolved, that the President is hereby authorized to confer with Dr. Merrill, and to agree with him as to his salary.

Further Resolved, that pending the installation of Dr. Merrill as Director-in-Chief, Dr. Marshall A. Howe, Assistant Director, fill the duties of that office as Acting Director-in-Chief.

RESOLUTION OF THE EXECUTIVE COMMITTEE OF THE ADVISORY COUNCIL

At a special meeting of the Executive Committee of the Advisory Council of The New York Botanical Garden on November twelfth, 1929, the following resolution was moved and carried:

Resolved: The Executive Committee, on behalf of the Advisory Council, wishes to express its sincere appreciation of the long and devoted service of Dr. N. L. Britton, who has resigned as Director of The New York Botanical Garden.

As founder and for many years Director of an institution of high rank for the benefit of scientists throughout the world, and for the education and pleasure of the American people, Dr. Britton has performed a noteworthy task, and this the Advisory Council here recognizes with gratitude.

The Executive Committee hopes that Dr. Britton's increased leisure will enable him to pursue with complete success the research work he has so much at heart, and it will follow these activities with much interest.

(Signed) IDA M. BODMAN,
Secretary.

DOCTOR ELMER DREW MERRILL, THE NEW DIRECTOR-IN-CHIEF

Dr. Elmer Drew Merrill, who took up his new duties as the second Director-in-Chief of The New York Botanical Garden on January 1, 1930, was born at East Auburn, Maine, October 15, 1876. He was graduated from the University of Maine in 1898,

with the degree of Bachelor of Science. He developed an early interest in plants and he states that one of the stepping-stones of his career was the exchange of selected herbarium specimens of the plants of Maine with Dr. N. L. Britton for a copy of Britton and Brown's "Illustrated Flora of the Northern United States,

ELMER DREW MERRILL
DIRECTOR-IN-CHIEF OF THE NEW YORK BOTANICAL GARDEN, JANUARY 1, 1930

Canada, and the British Possessions." His later studies of plants were of such a notable character that his *alma mater* conferred upon him in 1904 the degree of Master of Science and in 1926 the honorary degree of Doctor of Science. Following his gradua-

tion, Mr. Merrill was for a year an assistant in the natural science department of the University of Maine, after which he was for three years assistant agrostologist of the United States Depart-partment of Agriculture in Washington. In 1902 he became botanist of the Insular Bureau of Agriculture in Manila and later also of the Insular Bureau of Forestry, afterwards becoming connected with Philippine Bureau of Science as botanist. For several years, while holding the latter post, he was also the head of the Department of Botany of the University of the Philippines. From 1919 to 1923 he was Director of the Bureau of Science at Manila. In 1924 Dr. Merrill became Dean of the College of Agriculture and Director of the Agricultural Experiment Station of the University of California, in connection with which he has had wide administrative responsibilities. While a resident of California, he has taken a leading part in the organization of the new California Botanic Garden, located in Los Angeles.

Dr. Merrill is the author of more than two hundred papers dealing with the botany of North America, the Philippine Islands, the Marianne Islands, Borneo, China, etc. He has described about three thousand species and numerous genera as new to science. He is a fellow of the American Association for the Advancement of Science and the American Academy of Arts and Sciences, and a member of the National Academy of Sciences, the Botanical Society of America, the New England Botanical Club, the Malayan Branch, Royal Asiatic Society, the Deutsche Botanische Gesellschafft, and the Société Botanique de France, and a corresponding member of various learned societies. He was editor of the Philippine Journal of Science for nineteen years and has been editor of Hilgardia since 1925.

The following appreciative review of the career of Dr. Merrill was written by Dr. Charles B. Lipman, Dean of the Graduate Division of the University of California, and was published in the December number of the California Countryman, the official organ of the student body of the College of Agriculture:

"The resignation of Dr. E. D. Merrill from the position of Dean of the College of Agriculture and Director of the Agricultural Experiment Station at the University of California, is an occasion for the deepest regret to all those who have the interests at heart of the University in general and of the College of Agriculture in particular. It is given to few men who carry the burdens of an

important office with numerous and complicated problems over a period of years, to close their labors in such an office on terms of friendship with all with whom they come in contact and with themselves. Such, however, is strictly true in the case of Dean Merrill. In the period of about six years during which he has held this very important position in the University of California, Dean Merrill has exhibited in high degree a combination of qualities which are rarely found in one individual. His quickness of perception, his unfailing patience and courtesy, his great store of common sense, his promptness in taking action, his approachableness, and consideration of others have won for him the admiration and high esteem of his colleagues in the administration of the University and of those on the faculty. His enviable record as a scientist and administrator is too well known to need repetition here, but four stages of his career may be mentioned as contributing to those fine qualities of leadership to which I have referred above.

"The first of these stages concerns his early life, culminating in his graduation at the University of Maine, where he attained to the sterling characteristics which characterize the natives of that rugged state; namely, self-reliance, honesty, providence, directness of manner, and industry. The second stage of his career covers a period of some eighteen years as a systematic botanist in the Philippines and neighboring lands. There he learned the value of intensive application and concentration upon the task to which he had set himself of gaining knowledge of the tropical flora, culminating in a grasp of that subject which makes him a master and authority in that field of systematic botany and incidentally one of the best-known and most highly regarded American botanists in the systematic field. In the third stage of his career, to the extent of four or five years, he was concerned in addition to botanical study with directorship of the Bureau of Science in Manila. Here his inherent qualities for successful administration become manifest. There, as at the University of California, he succeeded in solving problems without friction and in earning the devoted friendship of his colleagues and other coworkers. The fourth stage of his career to the present has been as Dean and Director of the College of Agriculture at the University of California, where he has been instrumental in establishing one of the best sets of curricula for a college of agriculture which are available in the United States, and where he has encouraged and stimulated in a sympathetic and most effective manner the prosecution of research on fundamental problems which underlie the science of agriculture.

"It is fitting that as he takes leave of us to take up the exalted position of Director of The New York Botanical Garden, we of

the University of California record, not only our deep regret at losing him, but also our profound appreciation of his remarkable contribution to the success and effectiveness of the program of the College of Agriculture, of the scientific activity of the University in general, of our gratitude for the friendship and sympathy which he has shown to his colleagues unfailingly and of the high regard which we all entertain for him as a scholar, a scientist and, above all, a lovable human being. Dean Merrill carries with him to his new position in New York our hearty good wishes for his success during the long life which we all hope still stretches out before him. We wish him Godspeed."

[M. A. H.]

THE OKEECHOBEE GOURD

Several years ago we published an article giving some of the records of the wild gourds or pumpkins of Florida from the beginning of historic time and some notes on the wild cucurbit of the Lake Okeechobee region.[1] Although the Lake Okeechobee region was visited occasionally early in this century and even in the past century the cucurbit under consideration was apparently not discovered until early in the second decade of the present century, when the water highways through the Everglades, connecting Lake Okeechobee with the eastern coast of Florida were partly opened for traffic.

At that time the Okeechobee region was in its primeval glory. There was the largest freshwater lake within the United States, with the exception of Lake Michigan, framed by a dense mixed hammock—cypress and various broad-leaved trees—and behind this a vast pond-apple hammock, comprising thousands of acres. The Okeechobee pumpkin was rampant in both of these hammocks in most of the region safe from frost, and if the vines were killed during occasional "freezes" there were always enough seeds safely contained in the numerous pumpkins to continue a copious new growth of vines.

Today most of this hammock area has been destroyed, not only the hammock growth itself, but also the vast humus sponge in which the trees grew. This huge accumulation of humus not only

[1] Wild pumpkins. Journal of The New York Botanical Garden **23**: 19–23. 1922.

FIGURE 1. On the eastern shore of Lake Okeechobee. The Okeechobee-gourd on the edge of the hammock near the shore. The copious growth of the vines and the gourds may be seen as a result of a cold spell of weather which caused the tender leaves to fall. The roots and the seeds in the pods are not killed by cold weather, and the damaged plants are soon replaced.

held a vast amount of water, thus restraining the too rapid outflow from the lake in flood times, but also materially tempered the climate of the immediate region, making it, perhaps the most frost-free area in the Gulf region.

The Okeechobee pumpkin is still by no means rare, although it is becoming more localized, for at least ninety-five percent of its former geographic area has been reduced by fire to ashes and smoke. And no advantages have been gained to compensate for that which has been lost, perhaps forever.

This native pumpkin may be named and described as below:[2]

So far as we know, this pumpkin does not grow elsewhere. We once suspected that it grew about Lake Istokpoga,[3] which lies about twenty miles northwest of Lake Okeechobee. Exploration in the hammocks about Lake Istokpoga have so far failed to reveal it.

[2] **Pepo okeechobeensis** Small, sp. nov. Vine climbing over shrubs and tall trees. Stem and branches terete, finely striate-ridged, clammy-pubescent with short and long spreading hairs, the long hairs deciduous. Tendrils pubescent like the stem, the branches unequal, flattened. Leaves numerous; petioles pubescent and striate like the stem; blades suborbicular to orbicular-reniform and deeply cordate, mostly 1–2 dm. wide, irregular dentate and shallowly 5 7-lobed, with the lobes acute or rounded, softly pubescent on both sides, the veins impressed above, prominent beneath. Staminate flowers slender-pedicelled: hypanthium campanulate, pubescent; sepals subulate or subulate-lanceolate, 5–8 mm. long, finely pubescent, more or less spreading; corolla cream-colored, campanulate, the lobes erose-crenulate, each with a stout-subulate pubescent tip; filament column tapering upward, 3–4 mm. long, whitish, minutely pubescent; anther-head cylindric, about 2 cm. long, green. Pistillate flowers stout-pedicelled; hypanthium globular, finely pubescent; sepals subulate, 2–3 mm. long, finely pubescent, more or less appressed to the corolla; corolla cream-colored, campanulate, 6–8 cm. long, pubescent within and without, the lobes very broad, erose-crenulate, each with a gland-like tip in the apical notch; staminodia irregular scales; disk irregularly lobed; style enlarged upward, about 1 cm. long, greenish-white, glabrous; stigmas 2-lobed, green; pepo globular, 7–9 cm. in diameter, bright-green, usually flecked with whitish or darker-green spots and often longitudinally banded, with a hard woody rind covering a white flesh: seeds obovate, usually 1 cm. long, but varying from 8–12 mm. slightly turgid, thickish-margined.—Hammocks surrounding Lake Okeechobee, Florida.

[3] Journal of The New York Botanical Garden **23**: 22. 1922.

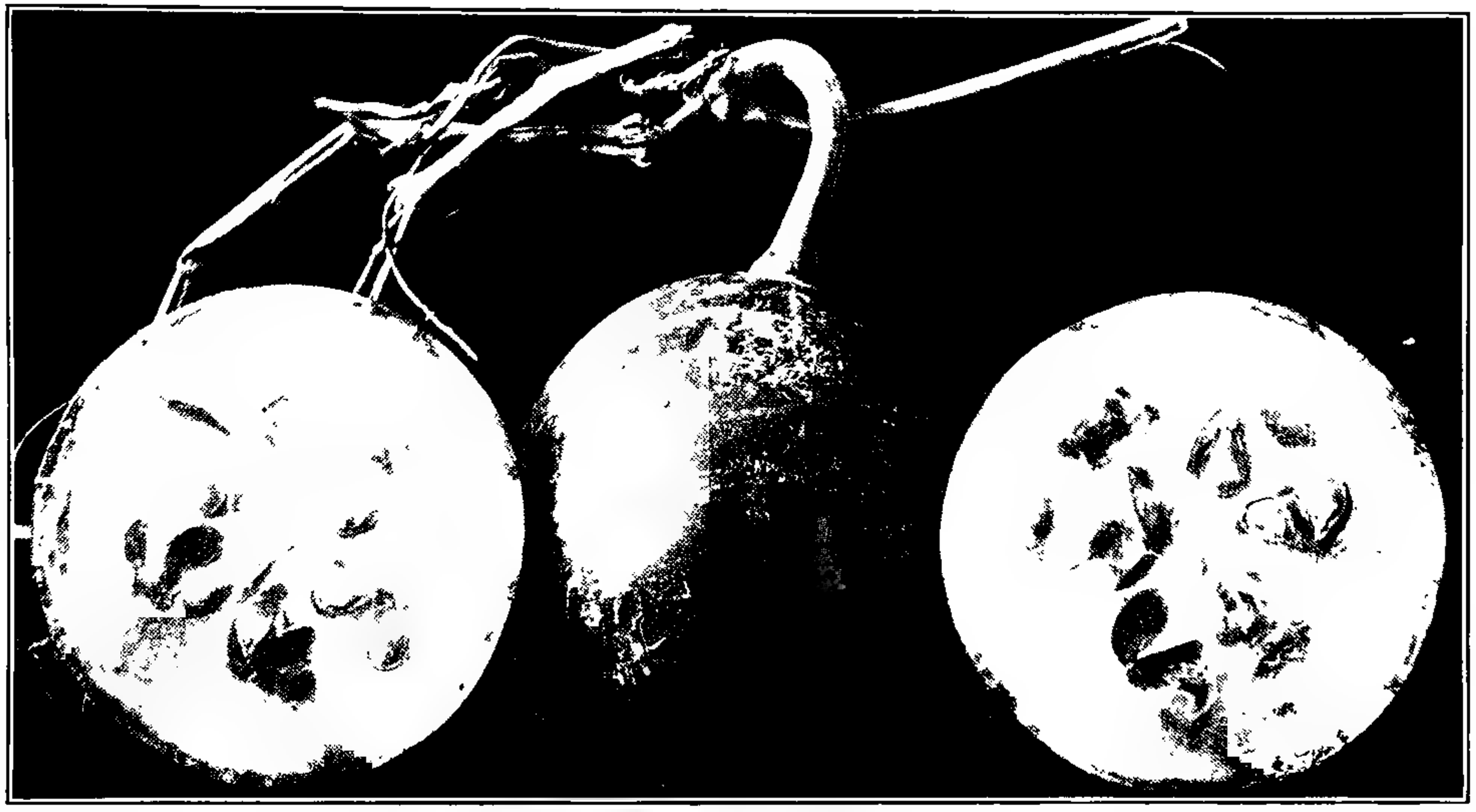

FIGURE 2. Fruits of the Okeechobee-gourd, about one-half the natural size. A hard thin shell covers a thin flesh within whose cavity the placentae and seeds are borne. The coloring of the surface varies from almost uniform green to mottled.

It would have been altogether natural to expect this pumpkin in the hammock islands of the Everglades, for the fruits could have floated all the way to the southern end of this prairie during the rainy season and lodged on these islands. But, so far, it has not been found, and furthermore there is little chance that it will be, for there is scarcely one of the myriad islands that has not been burned over during the past two decades.

This wild pumpkin will not withstand fire. It is less resistant to fire than the cultivated pumpkins, for the flesh of the fruits is much thinner, and when dry, together with the woody shell, readily burns and destroys the seeds. However, there is another pumpkin frequently met with in the islands and also about Lake Okeechobee and Lake Istokpoga, and also in many other places in the southern part of the Florida peninsula. It is the so-called Seminole Indian pumpkin, a variety of *Pepo moschata,* of unknown origin. Its presence indicates, usually, a former Indian camp site. Its vines are no more resistant to fire than the Okeechobee pumpkin, but its very fleshy fruits protect the seeds and thus insure a new crop of vines even after fire has swept over the spot where they grow.

JOHN K. SMALL

THE PETRIFIED FORESTS OF ARIZONA[1]

Every intelligent person today knows that all fossil wood was formerly the wood of living trees; but it may not be known to everyone that this, to us, elemental fact, was a subject of discussion and controversy until the early part of the last century. It might, indeed, represent a debatable subject today, in certain quarters, if someone should inadvertently use the term "evolution" in describing or discussing the progressive development of fossil from living wood, or the progressive development of our living trees from their fossil ancestors.

All of the older writers on natural history had very vague ideas in regard to the origin and nature of fossils in general. Gerarde, in his "Herbal," published in 1597, remarked, in con-

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, August 24, 1929.

nection with a description of a fossil tree-stump: "Among the wonders of England this is one of great admiration, and [it is] contrary unto man's reason and capacitie that there should bee a kinde of Wood alterable into the hardnesse of a stone called Stonie Wood, or rather [that there should be] a kinde of water, which hardeneth wood and other things into the nature and matter of stones." And, in 1693, John Ray, in his "Physico-Theological Discourses," expresses his doubt that nature should engage in useless and wanton ornamentation of rocks and stones by imprinting upon them the images of shells, leaves, etc., and finally observes: "Yet I must not dissemble, that there is a Phenomenon in Nature, which doth somewhat puzzle me to reconcile with the prudence observable in all its works; and seems strongly to prove that Nature doth sometimes ludere [sport or deceive], and delineate Figures, for no other end but for the Ornamentation of some stones, to entertain and gratifie our Curiosity, or exercise our Wits."

Fossilization may be due to any of several different causes. Wood, for example, in the form of lignite or "brown coal," is wood that has been buried in mass and subjected to pressure and a process of natural distillation, by means of which the volatile constituents of the wood have been more or less driven off and the solid carbonaceous parts represent the lignitic residue. This process may be likened, in a general way, to the process by which charcoal is made, and we may think of charcoal as artificial lignite, or lignite as natural charcoal. Lignite and semi-lignitized remains of vegetation in general represent one of the commonest forms of fossilization, for the reason that wherever dead vegetation accumulates –on forest floors, in swamps and lagoons, in the deltas of rivers, and elsewhere –the process of conversion into lignite is constantly going on to a greater or less extent.

Another form of fossilization is due to impregnation and partial or complete replacement of the wood tissues by mineral matter in solution—iron, lime, silica, etc. The wood is then said to be mineralized or petrified, that is, converted into stone. The original form and structure of the tissues may be entirely or only partly preserved, depending largely upon the extent of decay and disintegration previous to and during petrification, which is a slow process, even under the most favorable conditions.

The fossil forests of Arizona belong in this latter category, and the mineral matter concerned is silica, which has transformed the wood into agate, jasper, chalcedony, and other amorphous forms of the mineral quartz, with occasional cavities in which it occurs in the form of crystals. The wood, therefore, is petrified in general and silicified in particular. This process, of course, could have taken place only under peculiarly fortuitous conditions. Water—probably heated and alkaline—containing silica in solution, permeated the wood and, in the course of ages, this was deposited from solution as one or another form of quartz in place of the wood. The Arizona fossil forests are of Triassic age, which, in the eastern United States, is represented by the red sandstones and shales of New Jersey and the Connecticut River valley.

A number of specimens of the wood have been subjected to critical examination, and all, as far as I am aware, were found to belong to the gymnosperms and to be related to the existing araucarias, one of which—the Norfolk Island Pine (*Araucaria excelsa*)—is more or less familiar to us as an ornamental conservatory and house plant. In the existing flora of the world, about ten species of the genus are known, all of them located in the Southern Hemisphere, in South America, and Australasia. Their fossil ancestors, however, were widely distributed throughout both hemispheres, from Tasmania to Greenland, during Mesozoic time, when they reached their climax of development and then began to decline in numbers and to become more limited in their distribution. In the Northern Hemisphere the changing topographic and climatic conditions of the Tertiary period, that culminated in the cold of the Quaternary glacial epoch, caused their extermination everywhere north of the Equator.

The so-called "petrified" or "fossil" forests of Arizona are situated some six miles south of Adamana, a station on the Santa Fé R. R., in Apache County. They are, of course, "forests" in name only. They consist of a series of groups or accumulations of petrified logs which, during the Triassic period, when the trees were freshly fallen, were drifted into the region where they now are, were covered with sediments—clay, sand, and gravel—permeated with siliceous water, and thus, in the course of ages, were slowly petrified. Subsequently, when these sediments, trans-

formed into shales and sandstones, were elevated and subjected to erosion, the logs were either left scattered on the surfaces of the eroded areas or remained more or less exposed in places in the sides of gullies and the faces of escarpments.

If we can visualize a quantity of newly cut timber, ready for the sawmill, which has drifted down some river, become waterlogged, sank, and was then covered by the river silt, we would have an approximate picture of how these now petrified tree-trunks originally came to be where we now find them. The deltas of many great rivers, such as the Nile, the Mississippi, and the Yukon, represent such accumulations of débris in actual process of formation at the present time.

There are at least six of these accumulations of logs, or "forests," within the region, four of which are included in the reservation designated The Petrified Forest National Monument.

The proposition to set aside a portion of the region as a government reservation first took concrete shape in 1895. The Territorial Legislature of Arizona memorialized the Congress of the United States to direct that the Commissioner of the General Land Office withdraw from entry all public lands within the area specified and stating, among items of information in support of the memorial, that "ruthless curiosity-seekers are destroying these huge trees and logs by blasting them into pieces in search of crystals, which are found in the center of many of them, while carloads of the limbs and smaller pieces are being shipped away to be ground up for various purposes," and concluding with the words: "believing that this wonderful deposit should be kept inviolate, that future generations may enjoy its beauties and study one of the most curious and interesting effects of natural forces, etc."

After several investigations and reports had been made and submitted, a reservation of ninety square miles was authorized, and was created by proclamation of President Roosevelt in 1906. This, however, was subsequently deemed to be larger than was necessary, and was reduced to its present area of about forty square miles by proclamation of President Taft in 1911.

That these wonderful relics of the past were placed under government protection none too soon is well known to those who are acquainted with what was done, and what was projected, in con-

nection with the commercial exploitation of the material during the brief period after the region was readily accessible and was free to all who chose to go there and do as they might desire. Quantities of the logs were sawed into sections, polished, and made into table-tops and other ornamental articles; and one enterprising firm, that was engaged in the manufacture of an abrasive powder, had made arrangements to establish a plant there for the purpose of breaking up and pulverizing the logs on an extensive scale. All danger of commercial vandalism is now past, however, and even visitors are prohibited from breaking or injuring any of the logs in any way, although permitted to gather and carry away loose fragments from certain designated areas.

The lecture was illustrated by colored lantern-slides of the several forests and certain special features of each, and also by specimens of living Araucarias from the Garden conservatory, and rough and polished sections of the fossil logs obtained and donated to the Museum by the late Mrs. John Innes Kane.

ARTHUR HOLLICK.

CONFERENCE NOTES FOR NOVEMBER

The monthly conference of the Scientific Staff and Registered Students of the Garden for November was held on the afternoon of the 13th. A report of the three topics presented is as follows:

1. Dr. H. A. Gleason presented an account of the Melastomataceae of the Tyler-Duida Expedition and exhibited specimens of the numerous undescribed species collected by Mr. Tate, most of which come from the summit of the mountain. These will be published in a report on the botanical results of the expedition and require no further mention here. The collections from the lowlands, consisting mostly of known species, are noteworthy for adding to our herbarium new collections of the rare species *Opisthocentra clidemioides* and *Acanthella conferta,* both from their type localities.

2. Dr. N. L. Britton brought to the conference a large fruit and an herbarium specimen of the tropical tree *Bernoullia flammea* Oliver. The specimen, given by Prof. Samuel J. Record, of Yale University, represents a South Mexican and North Central American member of the Silk-cotton Tree family. It is noted

for the brilliance of its scarlet flowers in November and December, and is grown for the timber, called "Palo calabazo," or "Palo de perdiz."

3. Dr. Arthur Hollick presented the results of recent studies of Tertiary cycads, based upon leaves from Eocene deposits in southeastern Alaska, and trunks or stems from Miocene deposits in Kern County, California, followed by a discussion of Tertiary cycads in general, including the significance of their geographic distribution as indices of former climatic conditions.

The specimens from Alaska and California represent heretofore undescribed species in the genera *Dioön* and *Ceratozamia.* Previously described American species, from the Gulf States, the Antilles, and South America, are all referred to the genus *Zamia.* No Tertiary cycad remains have been recorded from the eastern or from the central part of the North American continent. The inference may be drawn, therefore, that during the Tertiary period climatic conditions on the Pacific Coast were milder than on the Atlantic Coast and in the interior, as they are today, and that the average temperature in Alaska at N. Lat. 57° was about that of northern Mexico and northern Florida at the present time.

Tertiary cycad remains in the Old World have been recorded from Europe, Japan, and Australia. The most satisfactory identifications of European specimens, from southern France and Greece, indicate relationship with the South African genus *Encephalartos.* The one recorded species from Japan is undoubtedly a *Cycas.* The one species from Australia is of doubtful identity as a cycad and is referred to the fossil genus *Inomozamites.*

The advancing of cold of the Tertiary period, which culminated in the extensive continental glaciation of Quaternary time, exterminated the European cycads. The mountain systems, running in an east-west direction, cut them off from migration southward. In Japan, however, a route of migration was open along the coastline. In America a similar condition obtained west of the Sierras on the Pacific coast, and along the Florida peninsula on the Atlantic coast. The former distribution of *Encephalartos* and *Cycas* in the Old World, and *Dioön, Ceratozamia,* and *Zamia* in the New World is exactly what might be ex-

pected when viewed in the light of what we know in regard to the distribution of these genera as elements in the existing flora.

A. B. STOUT,
Secretary of the Conference.

PUBLIC LECTURES DURING THE WINTER OF 1929–30

The course of free lectures and demonstrations during the winter months is given in the Central Display Greenhouse of Conservatory Range 2, of The New York Botanical Garden, on Saturday afternoons at three o'clock. The program follows:

Dec. 7. "Plant Nutrition," Dr. Forman T. McLean, Supervisor of Public Education.

Dec. 14. "What Ferns Are Best for the Home?" Dr. Ralph C. Benedict, Editor of the American Fern Journal.

Dec. 21. "Starch-bearing Plants," Dr. Marshall A. Howe, Acting Director.

Jan. 4. "Succulents," Mr. Kenneth R. Boynton, Head Gardener.

Jan. 11. "Construction and Planting of Rock Gardens," Mr. T. H. Everett, Head Gardener at the Manville Estate, Pleasantville.

Jan. 18. "Disease and Pest Control," Dr. B. O. Dodge, Plant Pathologist.

Jan. 25. "House Plants and Their Care," Mr. H. W. Becker, Foreman of Greenhouses.

Feb. 1. "Growing Exhibition Flowers," Mr. James Stuart, Head Gardener, Constable Estate, Mamaroneck.

Feb. 8. "Cold Frames," Mr. Kenneth R. Boynton, Head Gardener.

Feb. 15. "Rubber Plants," Dr. A. B. Stout, Director of Laboratories.

NOTES, NEWS, AND COMMENT

Mr. E. W. Killip, of the Smithsonian Institution, Washington, D. C., and Mr. A. C. Smith, Assistant Curator of The New York Botanical Garden, returned late in November from an expedition

to Peru, bringing back more than 9,000 field numbers of herbarium specimens.

The following visiting botanists have registered in the library during the autumn: Mr. E. J. Palmer, Jamaica Plain, Mass.; Prof. Samuel J. Record, New Haven, Conn.; E. H. Eames, M.D., Bridgeport, Conn.; Prof. H. H. Whetzel and Mr. Stewart H. Burnham, Ithaca, N. Y.; Prof. L. O. Overholts, State College, Pa.; Mr. John A. Small, New Brunswick, N. J.; Prof. Chas. S. Parker and Mr. William W. Diehl, Washington, D. C.; Mrs. Mary M. Holway, Minneapolis, Minn.; Prof. E. D. Merrill, Berkeley, Calif.; Mr. H. A. Ballou, St. Augustine, Trinidad; Dr. R. Nakazawa, Formosa, Japan, and Prof. T. Mackawa, Sapporo, Japan.

The meetings of the Botanical Society of America held in Des Moines, Iowa, from December 30, 1929, to January 1, 1930, were well attended and the usual interest was manifested in the various papers. The attendance was, however, doubtless reduced somewhat in anticipation of the meeting of the International Botanical Congress to be held in England next summer. The proximity of the State College at Ames, Iowa, gave the visitors a chance to look over the work of that institution, although the meetings of the mycological section were held in Des Moines. The New York Botanical Garden was represented by Doctors B. O. Dodge and F. J. Seaver, and the substance of the papers presented by them was printed in the January issue of *Mycologia*.

Work on the widening of Bronx Park East, authorized by an act of the State Legislature, began on January 3. This change involves a loss of a strip of land forty feet wide from the eastern margin of the Botanical Garden and the rebuilding of the boundary fence. Previous to the beginning of operations, many of the shrubs and smaller trees were transplanted and the more desirable topsoil was removed. An item of about $15,000 in the City appropriation for the street-widening is for the purpose of replanting the new eastern border of the Garden. It is expected that the widened Bronx Park East will carry a part of the north and south through-traffic that has been using the existing roads of the Garden.

Meteorology for October. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 74° on the 6th; *76° on the 13th;* 71° on the 19th and 20th; and 75° on the 27th. The minimum temperatures recorded were: 40° on the 5th; *31° on the 10th;* 32° on the 18th; 41° on the 25th; and 34° on the 29th. The total precipitation for the month was 4.83 inches.

Meteorology for November. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: *72° on the 2nd;* 62° on the 7th; 67° on the 15th; 57° on the 19th; and 54° on the 26th. The minimum temperatures recorded were: 33° on the 10th; 36° on the 16th; 24° on the 23rd; and *11° on the 30th.* The total precipitation for the month was 2.07 inches. The first killing frost was on the morning of the 22nd, though there was a light local frost as early as October 10th. There were traces of snow on the 23rd. All of the lakes in the Botanical Garden were frozen over solidly on the morning of the 30th.

Meteorology for December. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 53° on the 7th; *58° on the 15th;* 54° on the 19th; and 45° on the 28th. The minimum temperatures recorded were: 13° on the 4th; *10° on the 12th; 22°* on the 22nd; and 21° on the 23rd. The total precipitation for the month was 4.20 inches. A 4 inch snow on the 2nd, a 2-inch snow on the 12th, and a 2½-inch snow on the 23rd figured in the total amount of precipitation as .85 inches of rainfall.

Meteorology for the year 1929. The total precipitation for the year was 35.324 inches, including a total snow fall of 15.54 inches; which is figured as equal to 1.554 inches of rainfall. This was distributed by months as follows: January, 2.024 inches (including .104 as melted snow or 1.04 inches snow measurement); February, 4.11 inches (including .60 as melted snow or 6 inches snow measurement); March, 3.12 inches (only traces of snow); April, 4.84 inches; May, 3.15 inches; June, 1.13 inches; July, .74 inches; August, 1.52 inches; September, 2.69 inches; October, 4.83 inches; November, 2.07 inches, and December, 4.20 inches (in-

cluding .85 inches as melted snow or 8½ inches snow measurement).

The maximum temperature recorded during the year was 99° *on the 3rd of September.* The minimum temperature recorded was 6½° *F. on the 14th of January.*

A light local frost was as early as October 10th, while the first killing frost of the autumn occurred on the morning of November 22nd, when the temperature reached 27° F. The latest freezing temperature of the spring was 31° on April 2nd.

ACCESSIONS

LIBRARY ACCESSIONS DURING AUGUST, 1929 (CONTINUED)

NATHORST, ALFRED GABRIEL. *Nouvelles observations sur des traces d' animaux et autres phénomènes d'origine purement mécanique décrits commes "Algues fossiles."* Stockholm, 1886.

———. *Polarforsknings bidrag till forntidens växtgeografi.* n. p. [1883].

———. *Zur mesozoischen Flora Spitzbergens gegründet auf die Sammlungen der schwedischen Expeditionen.* Stockholm, 1897.

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———. *Zur paläozoischen Flora der arktischen Zone enthaltend die auf Spitzbergen, auf der Bären-Insel und auf Novaja Semlja von den schwedischen Expeditionen entdeckten paläozoischen Pflanzen.* Stockholm, 1894.

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RAMIS, ALY IBRAHIM. *Bestimmungstabellen zur Flora von Aegypten.* Jena, 1929. (Given by Dr. J. H. Barnhart.)

ROSENTHALER, LEOPOLD. *Grundzüge der chemischen Pflanzenuntersuchung.* Ed. 3. Berlin, 1928.

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SCHUSTER, JULIUS. *Weltrichia und die Bennettiales.* Uppsala, 1911.

———. *Ueber Nicolien und Nicolien ähnliche Hölzer.* Uppsala, 1910.

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THE NEW YORK BOTANICAL GARDEN
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ACCESSIONS

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FURTHER NOTES ON IRIS TROUBLES

SOIL STERILIZATION EXPERIMENTS

The continued dying-out of plants of many varieties in the Iris "variety beds" at The New York Botanical Garden was so extensive during the summer of 1928 that some experimental work on soil sterilization was begun, in coöperation with Mrs. Wheeler H. Peckham, Honorary Curator of Iris and Narcissus Collections.[1] The purpose was to prevent in replants the development of *Sclerotium Delphinii* and other soil fungi or bacteria responsible for those losses which were clearly due to disease. Of the one hundred plants set out in the bed treated with formaldehyde and Dip Dust, as noted on page 9 of the article referred to above, only four plants had died by August, 1929, *i.e.*, about one year after the replanting was done. The dead plants had been infested with the larvae of the lunate onion fly, *Eumerus strigatus*. The identification was obtained by Dr. C. R. Orton, who was coöperating at the time in the experiment. On the other hand, certain aconite beds in which also the *Sclerotium Delphinii* rot occurred in 1928, and which received no treatment, suffered severely from the disease again this year.

On April 1, 1929, the old plants which still survived in one of the untreated Iris beds, showing a great deal of disease, were taken up and the rotted parts of rhizomes cut away. The soil in the bed was dug up to a depth of ten inches and replaced with fresh soil. The rhizomes taken from the bed and treated with Uspulun were then replanted. On August 16, 1929, one end of this bed was photographed (FIGURE 1). The great benefit de-

[1] Dodge, B. O. Notes on some Iris troubles. Jour. N. Y. Bot. Gard. 30: 5-10. Ja 1929.

...and Iris bed four months after addition of new soil and disinfecting of rhizomes. planting after sterilization. (Compare with FIGURE 4 in the January, 1920, number

rived from the addition of new soil and treatment of the old rhizomes can be judged by comparing this figure with FIGURE 4, on page 8 of the January, 1929, number of this Journal. Both photographs were taken from practically the same location.

Although the past dry season has served to hold in check the development of fungous diseases in the untreated Iris variety beds, continued dying-out of scattered plants has necessitated the extension of soil treatment, rhizome disinfecting, and replanting to all beds.

BACTERIAL SOFT ROT

A noticeable amount of root rot has occurred in the "test plantings" at the propagating gardens during the past spring and summer. Single clumps, or several clumps in a row, have shown progressive drying of the leaves and final death of all plants in those clumps. Examination of the dying plants rarely failed to reveal a wet rot in the rhizome, exuding a sticky cream-colored substance with a disagreeable sour odor. This odor is a distinctive symptom of the Iris bacterial rot. The soft rot, although a frequent source of trouble in Iris beds, has not received the attention in the literature which its destructiveness warrants. *Bacillus carotovorus* Jones is generally said to be the cause of the rot, although other bacteria have been reported to produce the same symptoms.[2] This organism, represented by many different strains, also causes decay of a variety of vegetables, as well as of other ornamental plants.

No experiments have been reported determining exactly how *B. carotovorus* is carried from one plant to another, but Richardson's[3] observations have led him to suspect that it depends mainly on the soil, and that a wound in the host tissue is usually necessary for entrance of the bacteria. Infection may occur, however through stomata and lenticels. Smith[4] states that the usual mode of infection is through a wound in the host plant.

Richardson's work has thrown some light on the behavior of *B. carotovorus* within the plant tissue. He found it to be both

[2] Massee, George. Diseases of cultivated plants and trees, 519. New York. 1915.

[3] Richardson, J. K. A study of soft rot of Iris. Ann. Rep. Quebec Soc. Prot. Plants 15: 105–120. 1922–1923.

[4] Smith, E. F. An introduction to bacterial diseases of plants, 231. 1920.

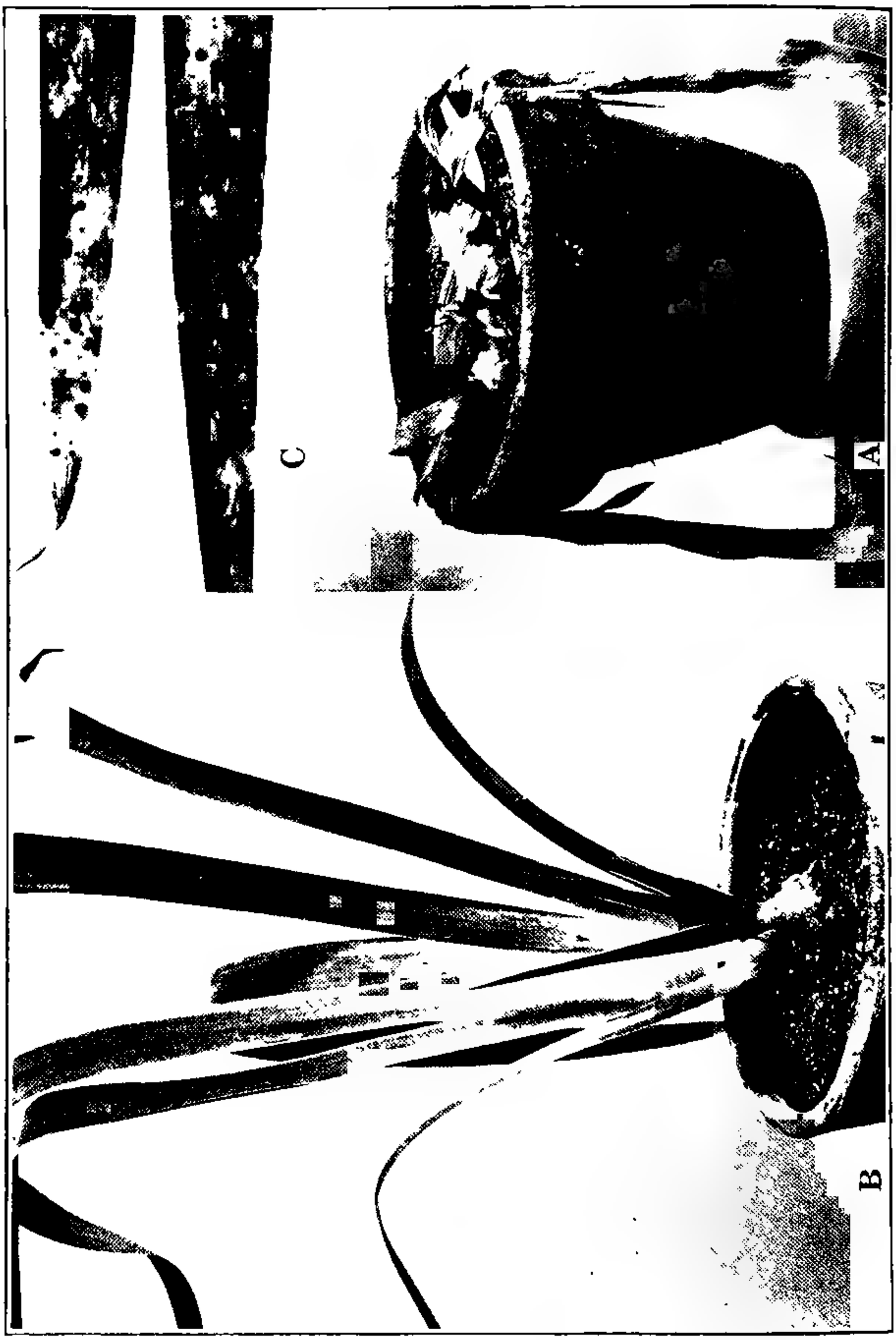

FIGURE 2 A. Iris plant eight days after inoculation with *Bacillus carotovorus*. B. Check plant wounded

inter- and intra-cellular. The cells of infected rhizomes were plasmolyzed, indefinite in shape, and showed disintegrated contents. The middle lamella was destroyed and the cells separated. A similar condition was found in the leaf tissue where the water-soaked areas marked the breaking apart and disintegration of the cells. The inoculation experiments of this investigator yielded no infection in the field, but in the laboratory his results were very similar to those to be described in the present account.

Inoculation experiments

Diseased plants in the " test " plantings at the propagating beds were the source of bacteria used in inoculations made in the laboratory and greenhouse in the present experiment.

All plants inoculated by puncturing developed typical rot symptoms, and bacteria were re-isolated from them. The work of the organism is evident in FIGURE 2 A, which shows a plant of the Hakador variety eight days after inoculation. FIGURE B is the control, a plant of the same variety, wounded with a sterile needle and receiving the same subsequent treatment as A. The progress of the wet rot upward from the base of the leaves where inoculation was effected is readily seen, as is the dull creamy bacterial ooze on the surface of the rhizome. The rotted tissue has been riddled by insects which were attracted in numbers to the diseased plants.

When bacteria from a culture were merely smeared on the surface of the leaves, no symptoms developed. Attempts were also made to cause infection by placing leaves of diseased plants in direct contact with those of healthy plants. Only one infection resulted. The positive results in this case were clearly due to the fact that the tip of the healthy leaf was broken.

A number of plants were brought into the laboratory, sprayed with a suspension of bacteria in sterile water, and placed under bell jars for observation. Infection resulted, but only after considerable delay, as compared with infection through wounding. In one case where the rot appeared after eighteen days, it caused three of the outer leaves of a plant to collapse. Later the pathogene seemed to lose virility and the plant recovered. In another case, water-soaked areas appeared after a few days at the tips of two leaves in contact with the moist wall of the bell jar.

D
C
B
A

The rot failed to develop further in one leaf, but progressed slowly downward in the other until, eleven days after spraying, this leaf collapsed. The following day the leaf next to the prostrate one showed the wet rot at the base progressing upward. The evidence seems to be that infection may occur through uninjured leaves, but only after some delay and under the most favorable of conditions for the pathogene. There is a possibility that the leaves of the plants sprayed with bacteria were not absolutely uninjured, but may have had small punctures such as may be caused by insects. In any case, the conditions in that respect were similar to those which would obtain in the field. The fact that infection may result from bacteria which have gained a position on the leaves by whatever means—the splashing of infected soil by rain, the crawling of insects, or contact with soiled tools—should be taken into consideration in dealing with the disease.

No reference has been found in the literature to root infection. Consequently, a plant was selected for observation of the effects of inoculation at that point. It was allowed to remain in a damp chamber for a few days after being pulled up. At the end of that time there were only three roots which showed no signs of injury. Two of these (FIGURE 3, A and B) were inoculated with bacteria by stabbing; the other (FIGURE 3, C) was stabbed with a sterile needle as a control. In two days the inoculated roots were brown, foul-smelling and soft with typical bacterial rot, whereas the control was still sound. A few days later, all the roots of this plant were sprayed with a bacterial suspension. Two days following, every root, except the original control (C), which had showed no injury, were rotting. This would indicate that infection might well occur, not only through the rhizomes and leaves, but also through roots and rootlets broken in the process of replanting and cultivating. The bacteria, however, are apparently unable to penetrate the unwounded root hairs and epidermis of sound fleshy roots.

Richardson reported a tendency of the organism causing soft rot to lose its infective power when kept in culture for several months. The strain used in the foregoing experiments has borne out this observation. The original isolation from diseased plants was made in June, 1929, and despite several re-isolations of the organism from inoculated plants, it has now (November) lost its

ability to produce symptoms of the rot and a fresh source of the bacterium must be found.

Control

In determining efficient control measures for the bacterial rot, the principal medium of transmission, namely, the soil, must be given first consideration. Sterilization with formaldehyde or other suitable disinfectant is frequently recommended. Replacement of badly infected soil with a new supply should go far in preventing recurrence of the disease. Some growers successfully prevent the rot by dusting "Semesan" about the base and in the hearts of Iris plants. Soaking the soil with proper mercuric compounds and treating diseased rhizomes with sulphur or a pink solution of potassium permanganate have also been recommended.[5] Injury to the plants should be avoided as much as practicable, and care should be taken in transplanting and cultivating that roots and leaves are not unnecessarily wounded. Another source of dangerous wounds in the rhizomes and roots may be the heaving action of thawing and freezing during winter months. In mulching to prevent this process, Mrs. Wheeler H. Peckham states that she has obtained the best results by the use of a thin layer of salt-marsh hay placed between the plants. Such treatment involves no danger of soil contamination and gives the rhizomes adequate protection from the heat of the sun and consequent thawing. Crowded planting favors the development of any disease through accumulation of rubbish and moisture. Ample space should be left between plants to allow free penetration of air and sunlight during the growing period.

Damping-off

A severe case of seedling damping-off was called to the attention of the pathologist this summer, and successfully controlled by a thorough spraying of the soil and young plants with Uspulun. Isolations from affected plants yielded cultures of one of the common damping-off fungi, *Rhizoctonia Solani* Kühn. Although this pathogene has a wide range of hosts, no mention has been found in the literature of its having caused such Iris trouble.

[5] Gregory, C. T., and Davis, J. J. Common garden pests. Published by Better Homes and Gardens. 1928.

Insects

Last summer's dry weather, while checking some of the fungous diseases, may have lowered the resistance of plants to a degree where certain insects became an unusual menace.

Aphid

Both Japanese and German Iris have been hosts to the aphid *Anuraphis Tulipae* Boyer during the past season and have required treatment with Black-Leaf 40 and soap. This sucking insect feeds on the upper parts of leaves as well as on the base near the growing point, often below the soil surface.

Verbena Bud-Moth

In August two insects destructive to the seeds of valuable crosses were reported at work in the Iris garden. One of these, the Verbena bud-moth, *Olethreutes hebesana* Walker, was first noted in its pupal stage. The brown pupa case projects from a black-ringed hole in the seed pod, where the larvae have been feeding for about three weeks. Three days after emergence of the adult, the eggs are desposited on the pod surface. The hatched larvae enter the pod and feed on the seeds until ready to pupate. As there are at least four generations during the season, several applications of an insecticide such as arsenate of lead should be made, beginning soon after the pods begin to form. The insect overwinters as larvae or pupae in cocoons on the leaves or within seeds.[6] It has been widely reported not only as a pest of Iris, but as a " general feeder " on plants.

Weevil

The other insect observed attacking Iris seeds was identified by Dr. K. F. Chamberlain, assistant state entomologist, as the weevil *Mononychus vulpeculus*. This insect tunnels through the seeds, eating out the embryo and leaving of each seed only a thin ring. At the end of a tunnel which sometimes extends through a whole row of seeds, the small dark weevil may be found with its flat disk-shaped body fitting snugly into the last seed it has mutilated. This pest has been commonly found in the seed pods of native Blue Flag, according to Dr. Chamberlain, but its occurrence on

[6] Ries, Donald T. Two Iris Insects. Bull. Am. Iris Soc., **32**: 27–47. Jl 1929.

cultivated Iris is somewhat rare. It was reported in 1921 from Connecticut[7] as eating the petals and breeding in the seed pods of Japanese Iris, and in 1926 in Iris pods on Staten Island.[8] Its presence in Bronx Park, though not in connection with Iris, has also been reported.[8] The limited extent of its injury to cultivated plants has not warranted a study of control methods, but, as the adult weevils are flying as early as May, applications of an arsenate of lead spray early in the season should kill the insect before its eggs are laid and the larvae bore into the pod.

Citrus Scale on Iris Plants

An interesting infestation -the Florida red-scale (*Chrysomphalus aonidum* L.) on Iris leaves—is illustrated in FIGURE 2, C. It occurred in the propagating greenhouse, where an infested citrus seedling and some Iris plants potted for experimental purposes were in proximity. This small circular red scale is usually confined to citrus plants in greenhouses, but may live on a variety of hosts. The injury was not considered serious and the insect was allowed to develop to determine to what extent Iris plants would serve as hosts. The plants affected present a very disfigured appearance with conspicuous chlorotic spots about the insects, converging into large yellow areas. So far, several varieties are infested, but, as the pest appears to be spreading, it will be necessary to treat infested plants in order to save them.

B. O. DODGE AND MARJORIE E. SWIFT

THE NEW SPECIES HEMEROCALLIS MULTIFLORA

The latest member of the wild daylilies to be discovered and named is the species *Hemerocallis multiflora,* a description and a colored plate of which were first published in a recent number of Addisonia (**14**: *pl. 464.* Je 1929). Since the genus *Hemerocallis* is a small one, comprising at present about twelve valid species, the addition of a new species is of some botanical interest. Also the members of this genus are of value as garden plants, and the

[7] Britton, W. E. Twenty-first report of the State Entomologist for 1921. Conn. Agr. Exp. Sta. Bull. **234**: 194.

[8] A list of the insects of New York. Cornell Univ. Agr. Exp. Sta. Mem **101**: 506. Aug. 1926.

new species is to be considered in this respect. The description and the plate of *H. multiflora* already published may be supplemented by photographs and by some remarks on the possible value of this new species for use in hybridization, which aims to obtain new daylilies of merit for culture in flower gardens.

Thus far there have been but ten plants of the species *H. multiflora* available for observation by the writer. These came to The New York Botanical Garden in 1925 as divisions of wild plants obtained at Ki-Kung-Shan, Honan, China, by Dr. A. N. Steward, then a member of the faculty of the University of Nanking. It is believed that these are the only plants of this species now in cultivation. These ten plants differ somewhat among themselves in vigor of growth and in the season of blooming. But in the characteristics of the flowers and capsules and in general habit of growth they are all very similar, and they are distinctly different from any other known species.

One outstanding character of this species is the rather large number of flowers which a scape may bear. The scapes are, as a rule, abundantly branched above and thus a single scape may produce as many as one hundred flowers during the entire season of bloom. But these flowers mature over a somewhat extended period, and so the plant has a long season of blooming and there are not many flowers open during any one day. The photograph of FIGURE 4 shows this condition; at the time when it was taken the scape had been in flower for several days and tiny buds were appearing from which flowers would open several weeks later. For a large well-established plant, there may be several scapes having from thirty to as many as one hundred flowers each, and the blooming of the entire plant may continue for a period of six to ten weeks. The specific name *multiflora* seems appropriate in regard to the total number of flowers produced by scapes.

During the four years that these ten plants of *H. multiflora* have been under observation at The New York Botanical Garden, one plant has always bloomed in July while the others have begun to bloom rather late in August, and in 1929 some continued to yield flowers until as late as November 22, which was the date of the first severe frost.

But the plants of *H. multiflora* do not have the "evergreen" habit of growth characteristic of certain other daylilies. Their

FIGURE 4

leaves turn brown in mid-autumn with the coming of near-freezing temperatures, after which the flowers of the late-blooming individuals continue to develop and open a behavior unknown for any other daylily.

In the so-called "evergreen" daylilies, new leaves continue to appear throughout the summer and autumn and the plants remain with fresh green foliage until severe freezing temperatures prevail. Of the wild species now known, only *Hemerocallis aurantiaca* is decidedly evergreen. The *H. fulva* is only slightly evergreen. The foliage of the species *Hemerocallis minor, H. Dumortierii, H. Middendorffii,* and *H. Thunbergii* dies early in autumn or even in late summer. The foliage of *H. citrina* remains green until rather late in autumn and then quickly turns to a conspicuous yellow-brown and soon falls flat on the ground. But meanwhile the *H. aurantiaca* and numerous of the named horticultural clons, such as Luteola, Aureole, Ajax, Golden Bell, Sir Michael Foster, Shirley, Mikado, Vesta, Wau-Bun, etc., continue to put forth green leaves. Some of the seedlings now being grown at The New York Botanical Garden which have the evergreen habit also have a second period of blooming, or, what is more common, an occasional scape with flowers appears throughout the late summer and autumn. In this behavior there is a tendency to become "ever-blooming." But this is different from the late-blooming habit of certain plants of *H. multiflora* which have one period of flowering, which continues after the foliage is nearly dead and until cold weather arrives.

FIGURE 4. A single scape typical for the species *Hemerocallis multiflora*. Three flowers are open; several have already bloomed; numerous buds, some of small size, will continue the blooming over a period of several weeks. This particular scape was photographed on September 14 from a plant that is late-blooming.

The scapes of all the plants of *H. multiflora* are rather slender, and frequently they are gracefully bending under the load of flowers and fruit. For a few plants the scapes are somewhat stiffly erect to a height of as much as four feet; for others they are shorter and more bending. The scapes of a single plant may be rather erect at one time and decidedly bending at another time. Such variations within a wild species are not uncommon; they are often the basis for the selection of different races, or of different clons. The plants with such minor differences as are seen

FIGURE 6. Showing variation in habit of growth seen among plants of *Hemerocallis multiflora*. Plant at left has scapes that are taller, more erect, and somewhat more branching. The flowers and capsules of both are almost identical.

in these plants of *H. multiflora* may be expected to give somewhat different habits of growth to the offspring from hybridization with other daylilies.

The species *H. multiflora* is itself not especially valuable as a garden plant. The flowers are of fair size and rather full with pleasing form and color, but they are scarcely large enough or sufficiently numerous on any one day to give a showy display of color in the garden.

Several plants of *Hemerocallis multiflora* have already been hybridized with other species, including some of those that bloom earliest in spring. This was accomplished by saving the pollen of

FIGURE 5. Typical flowers of *Hemerocallis multiflora,* about four-fifths natural size, showing the two extremes in orientation which flowers of daylilies may assume. The color is of a shade between chrome and cadmium-yellow -a grade of orange-yellow -and the surface is gold-glistening.

the latter. Many seedlings have also been obtained in crosses with hybrids and with named horticultural clons, including some that have large flowers and some that have flowers with pink and with fulvous colors. It is the hope that the desirable characteristics of *H. multiflora,* such as long period of blooming, numerous flowers to a scape, and late blooming, will appear among the offspring in combinations that give somewhat new types of daylilies for garden culture.

A. B. STOUT.

CHRONICLE OF EASTERN AMERICAN IRIS

The present wide spread interest in iris and the long neglect of our native irises as botanical, not to mention horticultural, subjects make a chronicle of our eastern species timely.

The technical botanical history of Iris in North America begins with the publication of Linnaeus' Species Plantarum in 1753. However, about two centuries, dating from the early records and specimens on which Linnaeus based his North American species, comprise the total historic chronology involved. The following American Iris chronicle will be of particular interest, especially in view of the impetus recent exploration in the Gulf States has given to the study of the native plants of the genus *Iris*. The sequence of events which makes up the Iris chronicle is exceedingly unevenly distributed through the two hundred years involved.

The authors and their botanical works in which American irises figure, published prior to the appearance of the Species Plantarum, are, arranged here in chronological sequence, recorded by Linnaeus as follows:

Leonard Plukenet (1641–1706), Almagestrum, 1696.

John James Dillenius (1687–1747), Hortus Elthamensis, 1732.

Jan Fredrik Gronovius (1690–1762), Clayton's Flora Virginica, 1739.

Georg Dionysius Ehret (1708–1770), Plantae et Papiliones Rariores, 1748-'59–'62.

Late in the seventeenth century, American irises found their way to Europe, either as living plants or as herbarium specimens. A number of species from the Atlantic seaboard were recorded in the Old World literature of that period. Linnaeus (1707–1778) assembled this matter and with the aid of specimens in some cases published in his Species Plantarum, *Iris versicolor*,[1] *I. virginica*,[2] and *I. verna*.[3] *Iris virginica* L. is not be confused with the usual *Iris virginica* of the horticultural trade.

[1] *Iris versicolor* L. Sp. Pl. 39. 1753; various provinces, eastern North America.

[2] *Iris virginica* L. Sp. Pl. 39. 1753; various provinces, southeastern United States.

[3] *Iris verna* L. Sp. Pl. 39. 1753; various provinces, southeastern United States.

The next important step in our iris chronology was made by Thomas Walter (1740–1788), pioneer American flora writer and maker of the second Botanic Garden in America, who described four species as growing in the region covered by his Flora Caroliniana. They were, *Iris hexagona, I. tripetala, I. verna,* and *I. versicolor.* Among these, *Iris hexagona*[4] and *I. tripetala*[5] were new species, while *I. verna* was the same as the Linnaean species, but his *I. versicolor* was the Linnaean *I. virginica.*

A year after Thomas Walter published on the four species of his region, another species was launched by William Aiton (1731–1793), in 1789, in his Hortus Kewensis. Thus *Iris cristata*[6] was added to the recorded American flora.

More than two decades elapsed before the genus *Iris* was again increased. In 1812 a quite unexpected quarter was heard from when *Iris fulva*[7] was published by John Bellenden Ker (1765–1842), from specimens collected near New Orleans, Louisiana.

Again only a year elapsed before another iris was added to the increasing list. In 1813, Henry Muhlenberg (1753–1815), published an *Iris virginica.* This specific name was untenable as Linnaeus had already used it for a quite different plant. But, in the following year, 1814, Frederick Pursh (1774–1820), described the same plant, apparently independently, under the name *Iris prismatica.* [8]

Within four years the heart of the Great Lake region contributed an iris to the growing list when Thomas Nuttall (1786–1859), published *Iris lacustris.*[9] Within a decade and a half of the publication of *Iris lacustris,* Thomas Nuttall contributed an

[4] *Iris hexagona* Walt. Fl. Car. 66. 1788; Coastal Plain, southeastern United States.

[5] *Iris tripetala* Walt. Fl. Car. 66. 1788; Coastal Plain, southeastern United States.

[6] *Iris cristata* Ait. Hort. Kew. 1: 70. 1789; various provinces, southeastern United States.

[7] *Iris fulva* Ker. Bot. Mag. *pl. 1496.* 1812; Gulf Coastal Plain, southeastern United States and adjacent biological provinces.

[8] *Iris prismatica* Pursh. Fl. Am. Sept. 30. 1814; various provinces, eastern North America.

[9] *Iris lacustris* Nutt. Genera 1: 23. 1818; northern end of the Mackinaw peninsula, Michigan, and opposite shores of Lake Michigan and Lake Huron.

additional iris from what was then the "Far West," *Iris missouriensis.*[10] However, in the meantime Justus W. M. Radius (1797–1884), published *Iris carolina* in 1822. This, however, was not an additional species, but a republication of Linnaeus' *I. virginica.*

Within a few years the far northeast produced an iris, for in 1840 George Penny, British nurseryman of the early part of the nineteenth century, published *Iris Hookeri*[11] from the eastern Canadian region.

At this point the discovery and describing of new species of Iris in eastern North America ceased for a period of over sixty years. It is true, however, as in the case of *Iris carolina* cited above, in a special article by Sereno Watson in 1888, the name *Iris caroliniana* appeared, but this, too, proved to be the same as Linnaeus' *I. virginica.*

We may for convenience divide the Iris chronology into three periods: the first period embraces the century and a half in which the species thus far referred to were described, ending with the beginning of the twentieth century.

There are a number of repeaters to be considered. Most of these come within that period as limited above. Disregarding misidentifications which found their way into print and which have now been crystallized in synonymy, we find *Iris tripetala* Walt. (1788) repeated as *I. tridentata* Pursh (1813); *Iris prismatica* Pursh (1814) appeared as *I. gracilis* Bigel. in the same year; *Iris cristata* (1789) appeared as *I. odorata* Pers. (1805). Furthermore, it should be recorded that *Iris versicolor* Walt. (1788) is *I. virginica* L. (1753); while *I. sibirica* Pursh (1813) is *I. missouriensis* Nutt. (1840); *Iris virginica* L. (1753) appeared as *I. carolina* Radius (1822) and *I. caroliniana* S. Wats. (1888), and was later rechristened *I. georgiana* Britton (1913).

The first sign of interest in native American *Iris* after the long spell of inactivity, was the publication of *Iris foliosa* by Mackenzie and Bush in 1902. Thus the beginning of the present century may be taken as the inauguration of the second period of our Iris chronology.

[10] *Iris missouriensis* Nutt. Journ. Acad. Phil. 7: 58. 1834; various provinces, western North America.

[11] *Iris Hookeri* Penny; Steud. Nomencl. Ed. 2. pt. 1, 822. 1840; northern New England Coast and eastern Canada.

After this beginning, more than two decades elapsed before documentary evidence of further iris activity appeared. As botanical exploration in the Gulf States progressed, evidences of irises unaccounted for in our botanical horticultural literature were brought to our notice. In 1924 two irises from Florida were published by the writer, and figured in color, namely *Iris savannarum*[12] from the savannas and prairies of peninsular Florida and *Iris Kimballiae*[13] from the delta of the Apalachicola River in northern Florida.

As the two above-mentioned species were being launched, evidences of additional undescribed species came to light from the Gulf region, and in 1927 four species which our field-work had brought to light were described, and figured in color. These represented a wide geographic range: Florida was involved again in *Iris rivularis*.[14] The other three species were found in the lower Mississippi River water-shed. *Iris Shrevei*[15] has the widest geographic range of the trio. It is related to *Iris versicolor* and *I. virginica*. The next in order as to extent of range is *Iris flexicaulis*[16] which is related to *Iris foliosa* which is native of the same general region. The more unusual plant of this trio and the most restricted in range is *Iris vinicolor*[17] which has a very unusually colored flower, vinaceous purple. This plant and some of its associates, at the time of its discovery in the spring of 1925, aroused our suspicions about the possibilities of further iris discoveries in the lower Mississippi Delta. Further exploration of this region confirmed our suspicions and our field-work there, up to date, has disclosed the most unique development of *Iris* in the world as far as number of species and variety of color in flowers is concerned in a very restricted area.

[12] *Iris savannarum* Small, Addisonia 9: 57. *pl. 317*. 1924; Coastal Plain, peninsular Florida.

[13] *Iris Kimballiae* Small, Addisonia 9: 59. *pl. 318*. 1924; Coastal northern Florida.

[14] *Iris rivularis* Small, Addisonia 12: 11. *pl. 390*. 1927; watershed of the St. Mary's River, Florida, and Georgia.

[15] *Iris Shrevei* Small, Addisonia 12: 13. *pl. 391*. 1927; lower Mississippi Valley generally.

[16] *Iris flexicaulis* Small, Addisonia 12: 9. *pl. 389*. 1927; lower Mississippi watershed.

[17] *Iris vinicolor* Small, Addisonia 12: 1. *pl. 385*. 1927; lower Mississippi Delta.

The next epoch in this second iris period was in 1929. This is conspicuously characterized by the launching of seven additional irises from the Coastal Plain of the Gulf of Mexico. All these were described and figured in March, 1929.

Florida, as in the case of the preceding quartet of new species, furnished one, namely *Iris Albispiritus.*[18] This is related to *Iris savannarum,* of which it long ago may have been a derivative.

The outstanding increment in this epoch came from the lower Mississippi Delta. Six species are involved—all of them exceptionally showy plants. They are *Iris violipurpurea,*[19] with a violet-purple ground-color in the perianth; *Iris giganticaerulea,*[20] with a violet-blue ground-color in the perianth; *Iris chrysophoenicea,*[21] with a plum-color ground color in the perianth; *Iris mirabilis,*[22] with a lavender ground-color in the perianth or white; *Iris chrysaeola,*[23] with a violet ground-color in the perianth; *Iris atrocyanea,*[24] with a very dark violet-blue ground-color in the perianth.

A total of twenty-four species have been referred to on the preceding pages. They are all growing in the study plantations of The New York Botanical Garden. In addition, there are growing in these plantations at least a dozen species that are not yet published. These more than three dozen species of *Iris* are known to be native in eastern North America.

These plants are all desirable horticultural subjects. All the species belonging to the first period have been in cultivation for many years. Those of the second period have recently been brought into cultivation in both America and in Europe. Those intended to form the third period are being distributed to *Iris* specialists for study and development. They will form a more interesting series than the members of the second period.

[18] *Iris Albispiritus* Small, Addisonia **14**: 1. *pl. 449.* 1929; peninsular Florida, particularly the western parts.

[19] *Iris violipurpurea* Small, Addisonia **14**: 1. *pl. 440* 1929; lower Mississippi Delta.

[20] *Iris giganticaerulea* Small, Addisonia **14**: 5. *pl. 451.* 1929.

[21] *Iris chrysophoenicea* Small, Addisonia **14**: 7. *pl. 452.* 1929.

[22] *Iris mirabilis* Small, Addisonia **14**: 9. *pl. 453.* 1929.

[23] *Iris chrysaeola* Small, Addisonia **14**: 11. *pl. 454.* 1929.

[24] *Iris atrocyanea* Small, Addisonia **14**: 13. *pl. 455.* 1929.

The collections at the Garden are divided into two sections. The plants of one section are grown in cold-frames, those of the other in the open. Thus two distinct flowering periods result and a much extended time and a better opportunity for study is gained. The various species, those described long ago, those recently described, and those yet undescribed are being hybridized. This crossing of the species, it is hoped, will produce many valuable additional horticultural subjects for this group of plants now so much in vogue.

The species from the lower Mississippi Delta are hardy up to the latitude of New York. Curiously enough, under conditions quite different from those of their native habitats, the plants flower as freely as they do in the Gulf region. Those from Florida are naturally less hardy, and unless protected, flower scantily or fail to flower, devoting what energy they have left after the winter to producing new rootstocks to replace the parts seriously damaged by freezing.

In addition to the plantations of these Eastern American irises at the Garden, mentioned above, collections designed for study and exhibition have been installed in widely separated regions, with very unlike soils and different meteoric conditions. Among these may be mentioned the reservations of Mrs. Arthur Curtiss James at Coconut Grove, Florida; of Mrs. George Alexander McKinlock at Palm Beach, Florida; of Mrs. Thomas Alva Edison at Fort Myers, Florida; of Mrs. Raymond Robins on Chinsegut Hill, near Brooksville, Florida; of Mr. Henry Lockhart, Jr., at Longwood in the Coastal Plain of Maryland; and of Mr. Clarence Lewis at Skylands Farm in the Ramapo Mountains of New Jersey.

JOHN K. SMALL.

THE PLANTING OF A STAHLIA ON ARBOR DAY IN PORTO RICO[1]

Dr. Agustin Stahl, whose useful life we meet here today to commemorate, was for many years a resident of Bayamón, Porto Rico, where he died in the year 1917. He practised the profession

[1] Arbor Day address at Muñoz Rivera Park, San Juan, Porto Rico, November 29, 1929.

of medicine, but his love was for the study of plants and of animals, and he added greatly to the knowledge of Porto Rican botany and zoölogy by his collections of specimens and his publications. Through these his name comes down to us and through the tree dedicated to him as *Stahlia* by the Spanish botanist Bello, in 1881, a charming tribute to his memory, and most appropriate, for this rare tree is known to grow naturally only in Porto Rico and on Vieques Island.

It is with peculiar pleasure that we plant in this new park a young *Stahlia,* raised from seed by the Forest Service, the seed obtained by your Chief Forester, Mr. William P. Kramer. It will be interesting for you to come here occasionally and observe its growth; old trees are recorded as becoming 20 meters high. But when you come, be sure not to touch or break the tree nor to trample the ground around it, for you might retard its growth or even cause it to perish; except for their care by foresters or gardeners, young trees should be undisturbed.

In the plaza of Bayamón there is a Caoba or Mahogany tree, planted in honor of Dr. Stahl in 1905 and now about twelve meters high, a beautiful memorial, but Caoba is not native in Porto Rico. An excellent account of his life and works has been published by your distinguished Commissioner of Agriculture and Labor, Carlos E. Chardon.

As to the tree itself, like many other native Porto Rican trees, it has become scarce through the destruction of most of the natural forests; we now know only two small areas where it exists in some abundance, and a very few isolated trees elsewhere. *Stahlia,* the name we use for it here, today, is its botanical name; the Porto Rican names Cobana negra and Polisandro are applied to it by woodsmen. Scientifically it is in the same botanical family as the Algarrobo, or West Indian Locust, the Flamboyant, or Royal Poinciana, and the Campeche, or Logwood. Its leaves are compound, that is to say, each leaf is composed of a number of separate leaflets; on the under side of these leaflets, to be seen through a magnifying glass, are many round, black dots, not found on the leaves of any other Porto Rican tree, and these enable us to know *Stahlia* by studying a single leaflet; its rather large, yellowish flowers form long clusters and are to be seen in the spring; its fruit is a hard pod, four or five centimeters long.

The planting of a Porto Rican tree is symbolic of the great need of extensive reforestation of this beautiful island. Originally, before its occupation by people from Europe, nearly the whole island was covered by forest trees; through clearing, the forests are now for the most part reduced to small areas on the higher mountains, and are quite insufficient. During every rain-storm immense quantities of valuable soil are washed from the mountains and hills down into the rivers and carried out into the ocean, causing great loss; if the higher parts of the island were again covered by forests this loss would be much reduced. At the present time the water in only a few of the rivers is ever clear, and these rivers rise in the forests; all the others are always muddy, caused by the soil they are wastefully carrying to the sea.

An abundant and cheap supply of wood for domestic fires and for buildings is also one of your urgent needs, and this may only be had by growing very many more trees. The Forest Service has made an excellent beginning in reforestation, but it needs wide expansion, and the active coöperation of all your people. This reforestation has included the planting of 12,000 Stahlias along the southern coast the past year.

You will long remember that today we have met to honor the memory of one of your most eminent men of science; your thoughts have been directed as his were to the study of nature and of nature's great importance in our lives; you will be prepared to give aid and sympathy to the progress of reforestation, and in this you will be wisely directed and guided by His Excellency, Governor Theodore Roosevelt.

N. L. Britton.

WHAT FERNS GROW BEST IN THE HOUSE[1]

Various kinds of ferns are so commonly grown as house plants and with such generally satisfying results that people sometimes jump to the conclusion that any plant will succeed in the living rooms. Unfortunately, this is not true, as many have found after

[1] Abstract of a lecture given at Conservatory Range 2 of The New York Botanical Garden on December 14, 1929, by the editor of "The American Fern Journal."

trying to grow some beautiful woodland plant in a clay pot inside a glass window.

Ferns, in general, are rather captious in their environmental requirements. The common Christmas Fern, the leaves of which lie flat and green under the snow at this time of the year, succeeds in dry upland woods and thickets but does not like a dry house condition. This is a common native species, which the amateur often mistakes for the cultivated Boston Fern.

There are a few kinds of hardy native ferns which can be grown indoors inside a special glass case (Wardian case) or even in a small glass aquarium, if the plant selected is small enough. The confined air of such glass enclosures approximates fairly well the moisture conditions of the outdoors. It is chiefly the dry air and usually high temperature of dwelling houses which ferns of all sorts dislike and suffer under.

To obtain fern plants which can stand up best under this rather unhygienic air condition, it is necessary to select certain tropical and subtropical species which naturally frequent surroundings where moisture is not over-abundant. The Boston Fern, derived from the wild Sword Fern of Florida and the tropics generally, is relatively resistant in its native habitat. The Bird's-nest Fern, which has, in the last few years, been grown in larger and larger quantities by the florists, is a native of islands of the Pacific, where it grows often as an epiphyte clinging to the branches of trees many feet above ground, with no secure subterranean sources in water.

The Bear's-foot Fern (*Polypodium aureum*), which, in the variety *Mandaianum*, has most beautifully ruffled leaves, is a fern of the American tropics with a penchant for perching on trees, like the Bird's-nest (*Asplenium Nidus*). In general, it appears that ferns adapted in the tropics to growing under conditions of uncertain moisture possess a quality of resistance to household neglect and thereby qualify as good house-ferns. Fortunately, in the Boston Fern and these other two just named, we have three extremely beautiful types.

There are many ferns of the tropics of a similar habitat which would probably grow in the house except for the fact that they reach proportions far beyond the space available, even in the most palatial mansions. Some of these species have a vine-like habit

and extend many feet up and down the trunks of trees. There are species of climbing ferns (*Lygodium* sp.) which have leaves as much as 100 feet in length.

In connection with the extensive production of new varieties from the original Boston Fern, itself appearing about 1895, the tendency of the florists has been to favor smaller and smaller types, as these are better adapted to grow and thrive in the limited amount of light which a window offers.

Mention might be made of the fact that there are ferns, or fern allies, which you can grow in an aquarium more or less successfully. Two of them are little floating forms, *Salvinia,* known as the Floating Fern, and *Azolla,* nicknamed the Mosquito Fern, whose haunts it frequents. The latter is found scattered over much of the United States, and, in other species, in the tropics. These little floating plants are scarcely recognizable, however, to the uninitiated, as ferns.

The most stately ferns are the tree ferns, one or two of which are often shown in florists' windows, with spreading expansions of pale yellow-green leaves (*Cibotium*). They are not, however, suitable for house growth except under very special conditions, as of small conservatories.

From the little Mosquito Fern of one half inch in diameter, ferns range in size to certain South Sea Islands species with trunks 80 feet high.

It is probable that the tropics still hold many fern species which would be suitable for house culture on the same basis as the Bird's-nest and Bear's-foot. However, fern-growing in this country is largely on the quantity basis, like the production of automobiles, etc. The grower is interested in producing tens of thousands, sometimes even hundreds of thousands, in a year, of single varieties. He does not find that it pays to experiment with novelties. However, for the individual, who has a small amount of greenhouse space, I can think of nothing more enjoyable and relatively easy than experimental culture from spores of various untried tropical types.

RALPH C. BENEDICT.

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THE TUMORS OF PLANTS AND HOW THEY DIFFER FROM ANIMAL CANCER[1]

While our knowledge of cancer dates back to ancient times, the recognition of swellings on plants as possible malignant growths is the result of studies made in the present. The lecturer briefly traced the development of various hypotheses which attempt to account for the origin of cancer in human beings and animals. It was pointed out that, while no definitely accepted theory has been advanced to explain the origin of cancer in man, the cause for swellings on plants has been ascribed to a tumor-producing bacterium. The name "crown-gall disease" has been given to these swellings. This disease occurs in nature on a large variety of economic plants, such as the apple, pear, peach, and almond trees, and most garden vegetables, especially the beet. It is interesting to note, the lecturer said, that certain house plants, like the begonias and the cacti, appear to be free from disease.

This disease may be produced artificially by wounding the plant and introducing the bacterium. After a period varying from two to four weeks, tumors or wart-like formations appear. The size and rate of growth of these tumors depend upon the position they occupy on the plant. The tumor does not spread but remains where the bacterial organism is introduced. This is one of the striking differences between animal and plant tumors.

Other agents besides bacteria are capable of producing swellings or overgrowths in plants. The agents belong to the animal and plant groups. Lantern slides of various domestic plants with artificially produced tumors were shown on the screen.

A careful analysis was then made of the characteristics of animal and human cancer. Step by step the lecturer contrasted the animal and plant diseases. The lecturer pointed out that while certain plants develop apparently malignant growths, that in the main, the plant cancer is not analogous to animal cancer. He emphasized the point that the crown gall is more wart-like in its behavior. However, he stated that the malignant types of plant cancers are distinct entities and belong to another category of the cancer disease.

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, September 14, 1929.

The speaker went briefly into a very detailed study of the cancer cells and showed that while human, animal, and plant cells were more or less similar in appearance, they differed in behavior. Photomicrographs of many types of cancer cells were projected on the screen.

The treatment of the plant for removal of their tumors is a simple surgical procedure. The use of radium and X-rays has also been tried by the speaker, not primarily for the purpose of curing the plant but principally to study what effect various doses of radium and X-rays have on the living cell. These studies were especially undertaken by the lecturer with the hope that light might be shed on the changes that occur in the cancer cell of man. Numerous lantern slides were shown on this phase of the lecture.

Besides lantern slides, living and preserved plants with tumors were shown. The experiments were done at Montefiore Hospital, New York City.

MICHAEL LEVINE.

CONFERENCE NOTES FOR DECEMBER

The regular monthly Conference of the Scientific Staff and Registered Students of the Garden was held on the afternoon of December 11, 1929.

Dr. B. O. Dodge reported on "An Albino Race of the Monilia Bread Mold." The origin of this albino race and the hereditary behavior of the albino character in breeding tests were discussed. The detailed report of this study will be published in the near future.

Professor W. J. Bonisteel gave to the conference "A Survey of the Genus *Aconitum*." During the past year seeds or living plants of about sixty different species of *Aconitum* have been obtained at the Garden for culture and for botanical study. A report was made of what has been learned about the cultivation of these plants, about the requirements for germination of their seed, and about the habits of growth. The toxicity of the species and their importance in medicine and in horticulture were also discussed.

A. B. STOUT,
Secretary of the Conference.

CONFERENCE NOTES FOR JANUARY

A monthly Conference of the Scientific Staff and Registered Students of the Garden was held on the afternoon of January 8, 1930.

Dr. B. O. Dodge and Dr. Fred J. Seaver, who attended the recent meetings of the American Association for the Advancement of Science and the Botanical Society of America at Des Moines as delegates from the Garden, gave reports of these meetings. Dr. Arthur Hollick presented an account of the recent meetings of the Geological Society of America and the Paleontological Society of America, held in Washington, D. C.

Mr. E. J. Schreiner reported on his determination of the perfect stage of *Cytospora chrysosperma* (Pers.) Fr. and of this report the following is a condensed summary:

In the fall of 1929 dead twigs of poplar were collected with perithecia of *Valsa sordida* Nke. and pycnidia of *Cytospora chrysosperma* (Pers.) Fr. in close association. Single-spore cultures of the ascospores of the *Valsa sordida* were made and these were grown on steamed poplar twigs. After 3 to 4 weeks pycnidia of *Cytospora chrysosperma* developed in all the cultures. *Valsa sordida* is therefore the perfect stage of *Cytospora chrysosperma,* the causal organism of the canker disease of poplars described by W. H. Long in 1918.

A. B. Stout,
Secretary of the Conference.

NOTES, NEWS, AND COMMENT

Dr. and Mrs. N. L. Britton are spending the winter in Porto Rico, where they are continuing their studies of its flora. They left New York on November 21 and are expecting to return in April.

Dr. H. A. Gleason, Curator, has been appointed Associate Editor of the new periodical, *Ecological Monographs,* to be published for the Ecological Society of America by Duke University. Publication will begin in 1931.

Dr. B. O. Dodge, Plant Pathologist of the Garden staff, is continuing his services, begun last summer, as consultant to a committee of the medical faculty of Columbia University in the investigation of some of the smaller fungi that cause human diseases.

No. 51 of the Bulletin of The New York Botanical Garden, consisting of an illustrated "Guide to the Pinetum" by Edmund H. Fulling, was issued last August. The guide will be of immediate use to students of the large collection of coniferous trees in the Garden and will prove of future interest as a historic record.

Mr. Chien P'ei of Chengtu, Szechuan Province, China, who has completed all of his requirements for the Ph.D. degree at Stanford University, except his thesis, has reported to the Garden for his thesis work. His subject is a taxonomic consideration of the Verbenaceae of China, the work to be done under the general supervision of Dr. E. D. Merrill, Director-in Chief.

Mrs. Adelaide S. Van Brunt died suddenly on January 12. Mrs. Van Brunt was responsible for the beautiful and accurate coloring of many of the lantern slide photographs of plants in the collection of The New York Botanical Garden. She was the widow of Mr. Cornelius Van Brunt, expert photographer of plants, who died in 1903. It is expected that a more extended account of the life and work of Mrs. Van Brunt will appear in a later number of the JOURNAL.

Among the Asiatic collections recently received for identification is an important one, comprising several hundred numbers, from Chihli Province, China, made by Mr. C. F. Li under the auspices of the Fan Memorial Institute of Biology, Peiping, China; and a large and important collection, approximating 800 numbers, made by Dr. R. Kanehira of the Kyushu Imperial University, Fukuoka, Japan, during the past summer in the Caroline and Marianne Islands.

During the past summer, Chaplain and Mrs. Joseph Clemens, who have prosecuted very extensive botanical explorations in the

Philippines, British North Borneo, Indo-China, and China, spent several months in Sarawak, Borneo. The collections made by them approximate 3,000 numbers, with between 25,000 and 30,000 individual specimens. The collection is to be studied by Dr. E. D. Merrill and the duplicates will be distributed from New York. Chaplain and Mrs. Clemens are now en route to San Francisco and plan to proceed to New York in the near future to assist in the work of arranging this, one of the largest and most important botanical collections ever made in Borneo.

At the annual meeting of the Board of Managers of The New York Botanical Garden, held on January 13, in the office of President Henry W. de Forest, 165 Broadway, Mr. Thomas A. Edison, Mr. Clarence Lewis, and Dr. E. D. Merrill were elected new members of the Board, and Dr. N. L. Britton, Mr. Henry W. de Forest, Mr. H. de la Montagne, Dr. Lewis Rutherfurd Morris, and Mr. Mortimer L. Schiff were reëlected to membership in the Board. The officers were reëlected, with the exception that Dr. E. D. Merrill was elected Secretary, succeeding Mr. H. de la Montagne, who had been Acting Secretary since August 1, 1929. Mr. Richard C. Colt, Mr. Henry Lockhart, Jr., Dr. D. T. MacDougal, Dr. E. D. Merrill, and Dr. William S. Thomas were added to the list of members of the Corporation.

According to Mr. Charles H. Totty, in a lecture on "Chrysanthemums," given at The New York Botanical Garden, November 16, 1929, the chrysanthemum, originally a Japanese flower, has been so improved in America in the past fifty years that the Japanese are now securing many of the newest varieties from this country. The anemone-flowered Japanese type of chrysanthemum was imported from Japan at the time of the Civil War in 1861. There are both hardy outdoor strains and tenderer greenhouse varieties. Most of the hardy kinds are either single flowers or little button pompons. There is a great range of color in each of the types, all colors being represented excepting blue. Some of the most popular in late autumn are the orange, bronze, and brown tints, which blend well with the autumn leaves. The best kinds for outdoor use are the relatively everblooming sorts which start to open about the first week in October and give from six to

eight weeks bloom. Most of these early varieties are of the large-flowered group. The pompons are later bloomers, coming in November. The type of chrysanthemum particularly commended by Mr. Totty and most admired at the present time is the anemone type, which is recognized by the cushion of long tubular corollas in the center of the flower. Many of these are quite hardy. Among them H. Wilson is pure white. Other good ones are Captain Boshen and R. Collins. Chrysanthemums are very easily grown, thriving in almost any kind of soil, but they blossom best if protected from the northwest winds. The plants should be divided every year and only one rooted sprout planted in a place. To keep the plants low and bushy, the young growing tops should be pinched back in the summer, about the middle of June. After they are through blooming the plants are easily wintered in any well-drained soil and they are benefited by a light mulch of leaves, which should not be removed too early in the spring. Among the pompon varieties, Queen of the Whites is very pretty and easily grown out of doors. Being a dwarf, it does not have to be pinched back very much. The early-flowering type was developed by crossing the hardy late-flowering pompons with the larger-flowered forms. Some of the most interesting of these are Mrs. Charles Stout, Lillian Doty, and Roupel Beauty, which is a deep pink. Bronze Queen is one of the best in its color. Mr. Totty also discussed rather fully the finest of the greenhouse varieties.

Meteorology for January. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 58° on the 2nd; *63½° on the 9th;* 49° on the 15th; and 36° on the 21st.

The minimum temperatures recorded were: 14° on the 5th; 16° on the 11th; *10° on the 19th and 20th;* and 13° on the 31st.

The total precipitation for the month was 2.465 inches. This includes 3¾ inches of snow measurement, which was figured as .375 inches of rainfall.

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Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

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THE NEW YORK BOTANICAL GARDEN
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JOURNAL
OF
THE NEW YORK BOTANICAL GARDEN

CHRONICLE OF THE PALMS OF THE CONTINENTAL UNITED STATES

JOHN K. SMALL

THE GLORY OF THE ANNUALS

ARTHUR HERRINGTON

MORRIS & EAMES' OUR WILD ORCHIDS

H. A. GLEASON

A BULLETIN ON "POLLINATION OF FRUIT TREES"

PUBLIC LECTURES DURING MARCH, APRIL AND MAY

NOTES, NEWS, AND COMMENT

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JOURNAL
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CHRONICLE OF THE PALMS OF THE CONTINENTAL UNITED STATES

At the time of the publication of the Species Plantarum, Linnaeus knew but eight kinds of palms. These were all from the Old World. They were botanically launched in 1753 and may be listed in a footnote as a matter of interest.[1]

This list of Linnaean palms represents the accumulation of the knowledge of highly specialized plants as a result of the slow growth of travel in the parts of the Old World more distant from Europe. Although the discovery of the New World had taken place over two centuries and a half before 1753, not one of its numerous palms was then described by Linnaeus.

In spite of his lack of material on which to make botanical descriptions, Linnaeus was, perhaps, not wholly ignorant of the oc-

[1] A list of these pioneer palms may be of interest. Linnaeus divided them into three groups as indicated below.

FLABELLIFOLIAE.

Chamaerops humilis—Dwarf fan-palm—Mediterranean region.
Borassus flabelliformis—Toddy-palm—East Indies.
Corypha umbraculifera—Sago-palm—Tropical Africa and East Indies.

PENNATIFOLIAE.

Cocos nucifera—Coconut-palm—Malay and Indo-Pacific region.
Phoenix dactylifera—Date-palm—Northern Africa and Arabia.
Areca Cathecu—Betel-nut—East Indies and Malay.
Elate sylvestris—Sugar-palm-of-India -East Indies.

BIPENNATIFOLIAE.

Caryota urens—Wine-palm—Tropical Asia.

The names Linnaeus gave these palms stand today, with the exception of *Elate sylvestris* which now is *Phoenix sylvestris.*

currence of palms in the New World, for there were many references to them in the records of travel brought to Europe from the Western Hemisphere. In addition, contemporaries and correspondents of Linnaeus, both direct and indirect, were exploring or living among the palms in parts of America. Among these may be mentioned John Ellis (1710–1776), Mark Catesby (1679–1749), John Bartram (1699–1777), Nikolaus Jacquin (1727–1817), Jean Aublet (1720–1778), Hans Sloane (1660–1752/3), Charles Plumier (1646–1704). However, when we compare the eight Linnaean species with the present known list of some fifteen hundred species, Linnaeus' knowledge of palms seems almost nil. It should be borne in mind that the lack of knowledge of American palms in Europe in the pioneer days of modern botany may have been due, in part to the difficulty of making, preserving, and transporting good herbarium material of this group of plants.

Following is a list of the palms of the continental United States, arranged in the order of the appearance of their specific names.

Cocos nucifera (1753)—Coconut-palm
Phoenix dactylifera (1753)—Date-palm
Sabal minor (1770) -Dwarf-palmetto
Thrinax parviflora (1788)—Silk-top thatch
Sabal Palmetto (1788)—Cabbage-tree
Serenoa repens (1791)—Saw-palmetto
Rhapidophyllum Hystrix (1814)—Needle-palm
Roystonea regia (1815)—Royal-palm
Coccothrinax argentea (1830)—Silver-palm
Pseudophoenix vinifera (1845)—Bucaneer-palm
Paurotis Wrightii (1866)—Saw-cabbage palm
Neowashingtonia filifera (1879) -Fan-leaf-palm
Thrinax microcarpa (1896)—Brittle-thatch
Sabal Etonia (1896)—Scrub-palmetto
Sabal texana (1908)—Palmetto-palm
Sabal Deeringiana (1926)—Palmetto-with-a-stem
Sabal Jamesiana (1927)—James'-palmetto

The type specimens of the species first found in insular tropical America and later discovered on the continental side of the Gulf Stream came from various islands of the West Indies. For example, arranged chronologically they are:

Thrinax parviflora (1788). Jamaica—Cuba, Bahamas, Florida.
Roystonea regia (1815). Havana, Cuba—West Indies and Central America, Florida.

Coccothrinax argentea (1830). Described from cultivated specimens—West Indies, Florida.
Pseudophoenix vinifera (1845). Santo Domingo—Cuba, Bahamas, Florida Keys.
Paurotis Wrightii (1866). Cuba—Bahamas, Florida mainland.

On the other hand, several species were first described from the continent and later discovered in the West Indies or Mexico. They are:

Sabal Palmetto (1788). Coastal Plain of South Carolina—Bahamas, Cuba (?)
Neowashingtonia filifera (1879). California—Lower California.
Thrinax microcarpa (1896). Florida Keys Bahamas, Cuba.

The palms endemic in the continental United States were naturally described from material derived from the southeastern States and California. Arranged chronologically they are, with citations of their type regions in geographical divisions, followed by their geographic distribution:

Sabal minor (1770). Exact regions not known. Described from specimens in the Schönbrunn Garden, Vienna.—Florida to Texas and North Carolina.
Serenoa repens (1791). Coastal islands. Georgia.—Florida to Louisiana and South Carolina.
Rhapidophyllum Hystrix (1814). Coastal Plain, South Carolina. —Florida to Mississippi and South Carolina.
Sabal Etonia (1896). Peninsular Florida.
Sabal texana (1908). Southern Texas. Lower Rio Grande delta.
Sabal Deeringiana (1926). Southern Louisiana.
Sabal Jamesiana (1927). Everglade Keys, southern peninsular Florida.

Two of the most important food palms of the world are naturalized within the range under consideration. They are:

Cocos nucifera (1753). India—Malay and Indo-Pacific region. —Now naturalized and cultivated throughout the tropics.
Phoenix dactylifera (1753). India—Northern Africa and Arabia.—Now cultivated in many tropical and warm temperate regions and often locally naturalized.

Taking up the species as they were published, we may start with the two exotics, which, however, are now naturalized members of our flora. In launching these two most economically important palms, Linnaeus had little to record. After short formal descrip-

tions and citations of earlier descriptions, he gives the original country of the coconut as "Indiae *paludosis, umbrosis*" and continues with "foliola omnia (excepto utrinque imfimo) retroplicata sunt, contra ac in sequente," which is the date-palm whose native country he cites as India. However, at the time Linnaeus wrote, the date-palm had a much wider range than given by him, and in fact the coconut had already been introduced into the Western Hemisphere.

The publication of the first of our native palms, *Sabal minor* (*Corypha minor,* 1770), an endemic too, was done by Jacquin with much more detail than the two preceding Linnaean species, and also with a colored illustration accompanying the description. However, there is no mention made of a definite type locality. Jacquin merely records, that "I have not been able to find mention of this elegant palm elsewhere. It flowered first in some year before 1773 in the Imperial Schönbrunn Garden, cultivated there by the superintendent, Richard van der Schot, an excellent Gardner and companion at one time on my American journey for the purpose of collecting plants for me." The colored illustration accompanying the original description, although made from a cultivated plant, leaves no doubt as to what palm Jacquin had. Botanically, the dwarf-palmetto dates from 1770, as *Corypha minor,* but it was referred to under the name "dwarf-palmetto" as early as 1765 by John Bartram, who records that, "This dwarf palm grows on the sea-coast from the Capes of Florida up to Charlestown in South Carolina, and bears bunches of berries something like black currants: These contain round horny seeds which are of the size of small peas, and are covered with thin pulp, which the Indians use for food. The leaves furnish them with thatch, and the soil where they grow is judged to be of middling kind between the sand and the swamp," he continues, ". . . the small palmetto or chamaerops yields a small white bud, no larger than one's finger which is eaten by Men, bears and horses in case of great need; . . .; we camped on a descending bank on the back of which was a scrub-oak and dwarf-palmetto or chamaerops; here we cooked a fine mess of palm-cabbage." The general affinity of the blue-stem is with tropical American types.

The first of our palms was published in Europe. The second, *Sabal Palmetto* (*Corypha Palmetto,* 1788) was published by Wal-

ter in America with more than Linnaean simplicity, the whole record comprising six words of description—a small beginning for a palm that soon after achieved much prominence and usefulness. As early as 1732, Catesby in referring to the Plant Palmetto, records that, "This kind of Palm grows also on all the maritime parts of Florida and South Carolina, whose Northern limits being in the latitude of 34° North, is also the farthest North that these Palms grow to their usual stature, which is about 40 feet high, . . ." The cabbage-tree is strictly a tropical American type of palm.

The third palm, *Thrinax parviflora,* 1788, took its place in botany remote from our region, having been published by Swartz as growing in Jamaica and Hispaniola, West Indies. Patrick Browne, who first referred to this palm, records that it is "frequent in Jamaica, and covers whole fields in many parts of the island." The silk-top thatch, as this palm is locally known, was introduced to our botanical literature in 1878 through specimens collected at the extreme northern part of its range on the west coast of Florida—the Cape Romano region. It occurs on the Florida Keys and the Cape Sable region. This thatch is also widely distributed in Cuba and the Bahamas.

The fourth palm, *Serenoa repens* (*Corypha repens,* 1791), also an endemic, as in the case of *Sabal minor,* was published in America by an American, John Bartram, who had much experience with this plant in the field. Writing of a region where palms form a prominent feature in the landscape, the sea-islands of Georgia, Bartram records, ". . . having observed, on the way, many curious vegetable productions, particularly *Corypha Palma* (or great Cabbage Palm), *Corypha pumila* [meaning the Dwarf-Palmetto], *Corypha repens,* frondibus expansis, flabelliformibus, plicatis, stipit. spinosis (Dwarf Saw Palmetto), *Corypha obliqua,* caudice arboreo adscendente, frondibus expansis, flabelliformibus, plicatis, stipit. serratis, . . ." These statements are the first of a strictly botanical character. The two forms Bartram refers to are common throughout most of the geographic range. Whatever was the habit of the saw-palmetto in the past, the typical form today is that with a prostrate and creeping stem, the *Corypha repens* of Bartram, *Corypha obliqua* is the more or less erect form whose stem has left the ground apparently originally from some

unusual irritation caused by drifting sand, fire, or water. There are many earlier non-botanical references to this palm in the records of exploration and narrative. These date back to within the sixteen hundreds or earlier. Although unlike any other palm, the saw-palmetto represents an American type.

The fifth species, *Rhapidophyllum Hystrix* (*Chamaerops Hystrix*, 1814), also an endemic, was published by Fraser, through the channel of Pursh's Flora, in 1814. There is evidence that the needle-palm was really discovered about the year 1802, but it was not botanically named until about twelve years later, for in 1818 William Baldwin in writing about the palms of Amelia Island, Florida, records that "*Chamaerops hystrix* is found along with the preceding [*Sabal minor*]—which it resembles closely, with the exception of its singular spines. It was discovered by the late Mr. John Fraser, about sixteen years ago, near the city of Savannah." Most of our palms are in a particular or general way related to the palms of the West Indies. The needle-palm, however, has its closest relatives far away in the East Indies. It is thus among the several peculiar Florida plants that have become widely separated from their closest relatives.

The sixth palm of our series, *Roystonea regia* (*Oreodoxia regia*, 1815), was not founded on material from the continental United States, but was published by Humboldt, Bonpland, and Kunth as coming from Cuba. It is not known who first observed the royal-palm in Florida, but it was noticed early in the past century, for Nuttall in the preface to his Silva of North America (1845) states that he was informed of the existence of a palm ninety feet high growing at some distance from the coast in east Florida.[2] Even earlier than the Nuttall record was that of William Bartram, who has recorded that this palm, without naming it, grew naturally along the Saint John's river in northern peninsular Florida during the latter half of the eighteenth century.

The seventh species, *Coccothrinax argentea* (*Thrinax argentea*, 1830), was unknown west of the Gulf Stream at the time of its publication. In fact, the native country of the original specimens is not known. It was not until within the seventies of the past century that the silver-palm was collected and definitely

[2] "East Florida," in colonial times, was the designation of our peninsular Florida.

recorded as a member of the flora of the continental United States. Apparently it was first found this side of the Gulf Stream on the Everglade Keys, southern Florida. Within our range this palm is now confined to the lower Florida Keys, the Bahia Honda region, the Cape Sable region, and the Everglade Keys. Occasional specimens may be found on the coastal sand-dunes along the Gulf Stream up to the Lake Worth region.

The eighth in the palm chronology is the California fan-palm, *Neowashingtonia filifera* (*Washingtonia filifera*), which was observed in the field and referred to in print long before it was botanically named and described. Early observers even confused it with the cabbage-tree (*Sabal Palmetto*) of the southeastern States. Although known for a long time the plants of this genus have not been thoroughly studied in the field. It is a question whether one, two, or three species are involved. Seeds or living specimens were early taken to Europe, and the tree soon became widely cultivated and almost universally noticed in horticultural publications. It is also cultivated in South America. Like the needle-palm it is not botanically related to the other palms of the area under consideration, but finds its affinity with palms of the Pacific Islands.

The ninth palm in our chronology is the bucaneer-palm, *Pseudophoenix vinifera* (*Euterpe vinifera,* 1845), which was discovered in Hispaniola about the beginning of the eighteenth century, but not botanically published until near the middle of the nineteenth century. Over forty years later it was published independently, described from specimens from the Florida Keys, where it was discovered in 1886. West of the Gulf Stream it is known from only three of the Florida Keys. Otherwise, aside from its type region, the bucaneer-palm is known only on the northern coast of Cuba and in the Bahamas. It came into prominence at an early date through the sugar which is stored in the trunk. This content was a handy source of an alcoholic beverage for the early bucaneers.

The tenth palm, the saw-cabbage palm, *Paurotis Wrightii,* (*Copernicia Wrightii,* 1866)), added to our series, was originally described from western Cuba. A full score of years passed before this palm was found on the continental side of the Gulf Stream. In 1887 this palm without flowers or fruits was dis-

covered in the Cape Romano region of the Big Cypress Swamp of Florida. In the fall of the following year, seeds and a few plants of the palm were secured, but it was not until a decade later that the flowers and fruits were brought to light. The saw-cabbage palm is unique in our palm assemblage, forming a group by itself. A primary distinguishing character is the underground stem development from which arise a gregarious series of branches or a colony.

The eleventh palm, described as late as 1896 from Florida specimens, is *Thrinax microcarpa,* 1896. Curiously enough, it is common in Cuba and the Bahamas, from neither of which regions was it ever given a botanical name as far as we can learn. It seems to be the common thatch-palm of the Florida Keys, ranging from the Ragged Keys to Key West. It was observed and collected several years before it was botanically described, and it is yet rather imperfectly known in relation to its associated thatch-palms. It produces the smallest fruits of any of our palms.

The twelfth species in the list of our native palms, the scrub-palmetto, *Sabal Etonia,* 1896, is one of our half dozen endemics. It was first seriously studied and published only a little more than three decades ago. As in the case of the palmetto-with-a stem, which was passed by undetected for over a century, this very distinct palm was literally trampled under foot by botanists for over a century, for it is a so-called stemless plant. Although it seems to attain great age, it never pushes its stem above the surface of the ground, but grows slowly and much contorted just beneath the surface. To those who have had to dig up the plants in clearing land, it is known as the "corkscrew-palm." The scrub-palmetto is confined to a plant association known as the scrub. The specific name is Indian and is taken from a particular locality—locally known as the Etonia Scrub. Being a Sabal, the scrub-palmetto represents a tropical American type.

The thirteenth palm in our chronology, the palmetto-palm, (*Sabal texana,* 1908), occurs a thousand miles due west from the congested palm region of Florida, or in other words in the lower delta of the Rio Grande in Texas. This plant has the longest history of any of our native palms. It was the first palm of the North American mainland referred to by Europeans. It is

crystalized in the early name of the present Rio Grande—the Rio de las Palmas recorded on a map about the beginning of the sixteenth century or in 1502. Although known for such a long period, it was not properly named and described until 1908, or fully four centuries after it was first observed. It has a limited distribution, occurring on both the Mexican and American sides of the Rio Grande near the mouth, and on the American side sparingly up to about sixty miles from the mouth. It has the same habit and is put to the same uses as its relative, the cabbage-tree of Florida and nearby states along the Atlantic Ocean, with which, in fact, it was associated as late as the latter part of the nineteenth century. It represents a tropical American type.

The fourteenth palm in our series, the palmetto-with-a-stem, (*Sabal Deeringiana,* 1926), as in the case of the palmetto-palm, takes us away temporarily from Florida, where a dozen of our palms are native members of the flora. The Gulf region of the Mississippi River Delta is here concerned. Although this palm was referred to in print as early as 1857, it was not described and named until 1926, or nearly seventy years later. It forms a connecting link between *Sabal* proper and the group *Inodes.* On the one hand the trunk is erect and on the other the leaf-blade is flat, but has a strong midrib, and the greatly elongate spadices are erect. It is naturally confined to the swamps and bayous of southern Louisiana, and like the other species of *Sabal* represents a tropical American type of palm.

The fifteenth palm to be considered in this series, growing naturally in the United States, is the James' palmetto (*Sabal Jamesiana,* 1927). This species was founded on plants and specimens, respectively observed and collected for several years previous to its publication. It is related to the cabbage-tree but lacks its robustness, as well as the strong fold in the leaf-blade and the stiff leaf segments. It seems to be confined to the high hammocks of the Everglade Keys in southern peninsular Florida. It is thus one of the endemics of that interesting floristic region, and it suggests the problem as to whether it is a developing or a vanishing species of *Sabal.* It is West Indian in character and may yet come to light in the forests of Cuba.

All the palms of the continental United States are in cultivation, usually a few kinds in various plantations; however, several

plantations contain specimens of all assembled together. The palm plantations that Mr. Charles Deering maintained in his reservations at Buena Vista and at Cutler before his death had a complete representation of this series, some of the plants exceedingly fine examples. Some of these are still thriving at Cutler. In recent years Mrs. Arthur Curtiss James has endeavored to assemble palms from all parts of the earth where palms grow. Her reservation now contains more kinds of palms than any other Florida plantation, and includes a full representation of those of the continental United States.

The preceding pages show a notable assemblage of palms for an extra-tropical region, where this group of plants is as a rule not to be expected. Judging from the geologic history, we may consider this dozen and a half palms a remnant representing the last stand of the group in temperate North America, following the most recent ice-age. Speaking for the present, it is safe to consider the group on the whole from a biological standpoint in a condition of *status quo,* with the possibility of its really being on the wane. Naturally, the decrease would be very slow, involving various natural factors; artificially, it is rapid as regards some palms. In the case of those species, for example, which have a wide geographic range, and a combination of mass in vast numbers and individual tenacity of life, man's present mania for destroying everything natural seems to make little progress. On the other hand, those species with a limited geographical range, and few representatives and individually susceptible to adverse factors, may be observed going to the wall within a generation, by the advance of civilization. For example, the natural growth of the royal palm has been wiped out in some localities and the largest grove of the bucaneer-palm which embraced from four to five hundred trees a generation ago, now can boast of less than two dozen individuals!

JOHN K. SMALL.

THE GLORY OF THE ANNUALS[1]

A great assemblage of garden flowers is comprised in the group that we designate as annuals. They are called annuals because

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, March 23, 1929.

they spring up from seed, grow, flower, provide for their own perpetuation with seeds, and die within the year.

Among these annuals are to be found flowers second to none in brilliancy, charm, variety, and fragrance; in fact, possessing all the attributes of true beauty, so lavishly displayed that we may in perfect truth call them glorious. They are naturally short-lived but in their short life-cycle there comes a period of exceeding gaiety. In the broad domain of Nature's garden among the many flowers which tell the story of the year the high lights and the bold striking effects are those of the annual flowers. The poppies of Flanders fields have been immortalized in verse because they flashed their brilliancy over the landscape, rising superior to the arch forces of destruction.

Some families of annuals are already quite popular, others not less beautiful are neglected or totally ignored. The garden possibilities with annuals are practically limitless. Even without a greenhouse or frame you may start in April or May with a broad expanse of bare earth acres in extent, plus the necessary packets of seed, and create a gay garden for the summer and autumn seasons, a maximum of beauty for a minimum of cost.

In the hardy flower garden you can grow only such flowers as are adaptable to the temperate regions. In the annual garden all parts of the world may be called upon to contribute, because many annuals from tropical countries will flourish admirably during our summer season.

Our chief concern, however, is not whence they came but where and how we can grow them best. But before we review with pictures the many types and varieties of annual flowers adapted to our gardens, a few practical cultural hints may be helpful:

Importance of Good Seed

First, I would emphasize the paramount importance of obtaining good strains of seed of any annuals you propose to grow. The mere name imprinted on the packet is no indication that the seeds in that packet will produce plants and flowers of the best types. Many of the finer types of the best families represent long years of patient selection by specialists; a lot of work is involved in keeping these selections true to type, form, and color. Seed prolificacy diminishes with higher development, whereas inferior types are most prolific in seed production. It costs no more to grow the

best and the difference between satisfaction or disappointment may be only a matter of paying a few more cents per packet on the original purchase.

Sowing the Seed

Some of the tenderer or slower-growing annuals are started early by sowing under glass, transplanting the seedlings and setting out young plants in the open ground when danger of frost is past. There are not many of these, however, and glass conveniences are not an actual necessity to a gay garden of annuals. Late in April or early in May when the soil has warmed up and is in good seeding condition you may sow your annuals where they are to flower, or if that is not quite convenient, sow in prepared beds and transplant when large enough to handle. If seed is sown where the plants are to flower, sow thinly, thin out the plants quickly and give each plant abundant room to grow. The very ease with which many annuals are raised operates to their disadvantage, for, if prompt and adequate thinning is neglected, growth is stunted, flowering starts prematurely, and the plants are short-lived. You cannot expect full and perfect development when six or more plants are growing in a space only large enough for the mature development of one. The ultimate distance apart may be six or twelve or even eighteen inches, according to their natural spread and stature.

Culture, therefore, is summed up in sowing the choicest seed obtainable, in well-prepared fertile soil, and giving every plant its place in the sun. Later on, when the plants are blooming, the removal of dead flowers, or of seed pods, if flowers have fallen, materially prolongs the floral display. The chief mission in life of any annual plant is maturing seed for self-perpetuation. Retarding or preventing seed production makes for a longer-continued flowering period.

We will now pass and review some of the many desirable and early grown garden annuals.

Asters

What we commonly call asters are not asters in the strict botanical sense. The true aster is a native perennial flower. The popular annual asters of gardens are the progeny of a Chinese flower botanically known as *Callistephus chinensis.* Their variety

is amazing in type, habit, and color. There are giants and pigmies, singles and doubles, and every color except yellow. The usual practice is to raise asters under glass and plant them out, but you can raise asters easily from seed sown in the open ground and have them in abundance throughout late summer and fall until frost puts an end to them.

Antirrhinums

These are popularly known as snapdragons or rabbits' mouths. They are not strictly annuals, as the wild species from which the beautiful modern types have been developed is a hardy bushy perennial European plant found growing among rocks and on old stone walls. Treated as an annual, however, it has glorious possibilities, but not being a true annual it requires a longer season of growth, so must be raised early under glass. Given the facility of a greenhouse or frame, so as to have good strong plants for planting outside late in May, Antirrhinums are the most persistent and most profusely beautiful flowers, continuous throughout the season if the old flower spikes and seed pods are removed. There are dwarfs which grow less than a foot in height, intermediate types growing from one and a half to two feet and taller types up to three feet or four feet. They have been so well selected and perfected that they can be relied upon to reproduce themselves absolutely true as to type and color, with a wide range of exquisite colors from white through every shade of pink to crimson with yellow and orange shades of splendid color effects.

Larkspur

There are true annual Delphiniums, the greatly improved progeny of wild species known as *Delphinium Ajacis,* a common weed in British cornfields. They are easily grown, long-lasting, and profusely blooming, varied as to types and colors from dwarfs of one foot to taller varieties up to three feet or more, embracing many shades of color from white through pinks to scarlet and from palest mauve to deep indigo-blue.

Poppies

Annual poppies are sufficient in number and variety to make a garden of them alone. They should always be sown where they are to flower, as they do not transplant with success. The Shirley poppies are a selected strain originating from the common red

poppy of European fields. They flower early and are over in early summer but as a succession there are the great double and single forms of the opium poppy, *P somniferum,* and if you have never tried these easily grown flowers try them and you will be amazed at their striking and variable beauty in a whole gamut of color from white to pink, mauve, scarlet, crimson, and black. They will make a truly brave show in the summer garden.

Argemone mexicana

An annual yellow poppy from Mexico, both interesting and pretty.

Sweet Sultan

This is a gem among annual flowers, perhaps not as easy to grow as many others. The beautiful varieties in cultivation are the progeny of a wild species named *Centaurea suaveolens* from the Levant. Coming from a warm country it wants a warm free well-drained soil to do well. If you can make it grow in your garden, it is an exquisite flower, both on the plant and when cut, lasting long in water and possessed of a refined fragrance. It embraces many shades of color in white, yellow, mauve, purple, and red.

Nemesia

A South African annual of exceeding beauty, with a wide color range. Our summer heat is detrimental to it but from plants raised under glass and planted out in early spring, perhaps in partial shade, it should flower for a period before the days of great heat arrive. It arrests the attention and commands the admiration of all who see it.

Lavatera

This is an annual mallow from the south of Europe and therefore ought to do well with us. It does wonderfully in British gardens but has been a disappointment with me, although in a friend's garden on the New Jersey coast it did much better. Apparently the heat of July and August is not to its liking, but if sown very early it would do well before the very hot days arrive. Having heard it highly praised by English gardeners, I thought I would give my neighbors a welcome surprise, so late in May I lifted my Darwin Tulips which had been four years in the same border and sowed this Lavatera, but what I actually showed them

was a very fine later border of zinnias, and these were not sown till the third week in July when it was apparent the Lavatera was not coming up to expectation. The zinnias, even sown at this late date, saved the day and redeemed a border from being otherwise flowerless.

Sunflowers

Everybody knows these, but most sunflowers are tall and coarse. Some bronzy red varieties are now offered that are distinct and interesting. There are, however, small-flowered and dwarf varieties of sunflowers most desirable in the annual garden. They are hybrids of another species, *Helianthus debilis,* and make great spreading bushes three to four feet high and wide. They flower all summer and fall. The flowers are light and graceful, most useful for cutting and if there are any humming birds in your vicinity you will see them hovering over and settling upon these flowers.

Cosmos

This needs no eulogy. It is the tallest and latest of annuals but a great joy in its season. There are now early summer-flowering forms not quite as large of flower but none the less gracefully pretty and valuable for cutting. A double-flowered Cosmos is now on the market and is a really pretty type. It was used extensively in a basket of flowers at an exhibition late in October and many inquiries were made as to what the flower was. There is also a yellow Cosmos, but this seems to be of a different character and sparse-flowering.

Cornflower

So called doubtless because it is a weed in the cornfields of Europe. It is really a Centaurea, but very hardy, easy to grow, has a long flowering season and can be had in light or dark blue, pink and white.

Statice

This is popularly known as sea lavender and is not only attractive in the garden, but the flowers are everlasting and can be kept for a long time. They can be had in varied shades of pink, rose, mauve and yellow.

Salpiglossis

Overhead a bright August sun, beneath the eye a mass of Salpiglossis and you have a flower picture of incomparable beauty. Words are inadequate to express their striking color tones, in velvet-crimson or burnished bronze, rich crimson veined with gold, pale yellow veined with blue or purple, a perfect riot of rich harmonious coloring. Truly a remarkable family worthy of the best and most extensive culture.

Godetias

This is another great group of easily grown, long lasting, and most profusely blooming annual flowers. There are pigmies that grow less than a foot in height, veritable little mounds of blossom and tall kinds up to three feet or more, branching and graceful bushes. Some are single, others double, and the colors range from white to pink, rose, scarlet, and crimson. I have seen an acre of them in glorious bloom, and the only befitting word is phenomenal.

Zinnias

Truly an annual for everybody and deservedly popular. The specialists have done wonders with them, so that you can now buy them according to color and in the best strains they will come 95 per cent. true to color designation. You can have them dwarf, intermediate or tall. They commence to bloom early and continue till cut down by frost, a long-lasting feast at little cost. Some have thought them a stiff common-looking flower. If any of you think thus, then make yourself acquainted with the new types of Zinnia, for they are destined to increase this flower in popular favor. Have you seen the quilled Zinnias? The petals, no longer flat, are quilled or enfolded, giving a lighter more airy effect in colors of bronze, cerise, yellow, the color on the inside of the petal different from that on the outside. Few people seem to know them as yet. I have shown them to critical, fastidious, flower-lovers and they proclaim them a real acquisition. Another strain is called the cactus-flowered. These have curled and pointed petals like a Cactus Dahlia. If you are off with the old love for Zinnias, you will assuredly be on with a new love as seen in these recent developments of the flower.

Chrysanthemums

There are annual Chrysanthemums of variety and beauty, continuous and long-lasting in bloom and admirable for cutting. Their progenitors are simple wildings found in European fields. From *Chrysanthemum carinatum* there has been developed a lovely group, the flowers strikingly colored with concentric rings of contrasting color. From *C. coronarium* have been raised charming varieties in single and double white and yellow flowers and they all grow as easily as weeds.

Coreopsis

A California wild flower but in its garden development an annual of highest merit, rich in glowing yellow, brown, and crimson, graceful in the garden and charming for cutting.

Jacobea

This is a South African group botanically known as *Senecio elegans.* The single types are like small Cinerarias and there are double-flowered kinds of great merit in white, rose, purple, and crimson.

Scabiosa

The Sweet Scabious is all the name would imply. A graceful long-lasting exquisitely fragrant flower, delightful for cutting and of every conceivable shade from white through pink to cherry-red, pale lavender, deep crimson and almost black. I have known them to keep sweet and fresh for two weeks as a cut flower in the house.

Marigolds

Among these there are two well-defined groups known as French and African, both of inestimable value for color effect in the garden throughout late summer and fall. The French marigolds make low-spreading bushes smothered with flowers. There are single and double types in the most glowing shades of yellow, brown, and chestnut red. The African marigolds have great double flowers of a lemon- or orange-yellow. Their odor may not be pleasing but is apparent only when handling them. They are strikingly effective as a cut flower when loosely arranged in wide spacious bowls and they outlast any other flower when cut. In the garden, too, they can stand considerable cold, as it takes quite a severe frost to put an end to their persistent flowering.

Calendulas

An old garden favorite is the Calendula or pot marigold. These too come in lemon and deep orange shades. The flowers are smaller in the hot days but they are hardy and easily grown. If sown early, they soon come into bloom and one can have them of full size and perfection for several weeks before the great heat of summer diminishes their beauty. A late sowing, too, gives good results in the cooler fall days.

Love in a Mist

Nigella. A simple little flower but exquisitely pretty, provided one has the best blue strain. It is very hardy and best in the early season. Make an early sowing and associate it with the pale yel low Calendulas and you will have a most pleasing combination.

Dianthus

The annual pinks are of great value in the annual garden and are well worthy of a much more extended planting. They are easily raised and the best strains have been so perfected and selected that they come very true to type. They flower freely and persistently all through the season, are brilliantly effective in masses in the garden, while for cutting and use in the house their form and fragrance are most appealing. There are single and double-flowered varieties in every shade of color from pure white to deepest crimson.

Acroclinium roseum

The everlasting flowers or straw flowers as they are now commonly called are quite a family, most of them natives of Australia. Besides the Acroclinium there are Rhodanthes, the Helichrysums, and others. Apart from their beauty in the summer garden how delightful they are when cut and dried for winter use in the house. They embrace almost every shade of color.

Swan River Daisy

Brachycome iberidifolia is a charming daisy-like Australian annual, flowering persistently all through the season. It grows less than a foot high and there are white, rose, and blue-flowered forms.

Linum

The flax family has some charming annual kinds, the most noteworthy being *Linum grandiflorum rubrum*, which has bright scarlet flowers appearing persistently for many weeks.

Viscaria

A dwarf but pretty annual most effective in masses with white, pink, rose, carmine, or blue flowers.

Californian Poppy

The Eschscholtzias are well known and deservedly popular. They are brilliantly effective in masses of feathery foliage and glowing flowers in every shade of yellow from palest straw-color to deep orange, while the variety Rosy Morn presages an even wider color range in the future.

Phlox Drummondii

This is a Texas wild flower but its garden development has raised it to an important position in the annual group by reason of the many distinct types now in existence. The best strains come very true to color and the color range is from white to deepest crimson, with every conceivable intermediate shade. There are full round-flowered types and others with pointed petals of a lighter effect, all easily raised and grown, persistent and long-lasting in flower.

Dimorphotheca aurantiaca

Is a terrific name for an exquisite yellow daisy which comes from South Africa. It is a brilliant flower, comes early into bloom, and continues over a long period. The original type has rich orange flowers but there are others now to be had in pale yellow, buff, and salmon hues.

Verbenas

These are old garden favorites but they must be started early under glass to insure strong flowering plants.

Nasturtiums

These are so well known it is needless to praise them. Some are dwarf, some are climbing and all are delightful. Avoid rich ground when planting them or the flowers will be hidden in an exuberance of leaf growth.

Candytuft

A very old garden annual but charming all the same in early summer days. It can be had tall or dwarf and in many shades of color.

Stocks

These are a very important group in European gardens but our summer heat is not to their liking. Plants raised under glass and planted out would flower before the very hot days. Somewhere in the garden, however, scatter a few seeds of the night-scented stock, *Matthiola bicornis,* and perhaps even before you have observed it in flower you will find some evening your entire garden is pervaded with an exquisite perfume.

Nicotiana

Even the tobacco family has some members that are grown for their beauty, such as the Sanderae hybrids, showy and abundant bloomers in rosy hues, and especially the white *Nicotiana affinis,* which exhales its perfume on the evening air.

Sweet Peas

The sweet peas are a veritable host and too comprehensive to enlarge upon on this occasion.

Portulaca

If you have some poor light soil wherein most annuals would starve, sow it with Portulaca and the entire area will become a mosaic of brilliant hues.

Sweet Alyssum

An old favorite and delightful, too, as an edging to beds and borders.

Gypsophila

The annual Gypsophila is indispensable for its many uses as a cut flower.

Mignonette

Another old favorite of which one never tires because of its delightful fragrance.

The selection here shown surely demonstrates the Glory of the Annuals though it by no means exhausts the subject. Other important groups, such as the Clarkias, Lupines, Petunias, Celosias and many others are equally worthy of the same prominence. Spacious indeed must the garden be if one attempts to grow them all.

ARTHUR HERRINGTON.

MORRIS & EAMES' OUR WILD ORCHIDS[1]

Few nature books have received so much attention and attracted such favorable comment from critics and reviewers as this handsomely illustrated book of orchids. For that reason we may pass by its literary and artistic merits without further remark, and proceed to point out some of its more strictly scientific features. We must insist, however, that the book is unique among the literature of the out-of-doors in the degree of success with which it has combined literary charm and scientific dependability.

Most of our nature books, particularly our nature guides of all sorts, are notoriously incomplete. The particular flower which attracts our attention by the roadside, or the bird which we observe along the shore, are the very ones to be omitted. After a few such experiences with these books one becomes rather doubtful about the reliability of the identifications which he makes and rather hesitant about using them. This orchid book, on the other hand, is complete. It covers the so-called " Manual range," of the northeastern states and adjacent Canada, and includes every species of orchid known to occur there. Not one has been omitted, or admitted on second-hand evidence. Every one has been seen in the field by the authors themselves; every one has been photographed in the field; nothing has been borrowed or stolen to fill the book. Every species is adequately described, but not in too great detail, and every one has been illustrated by one, two, or even three full-page plates. This is a botanical achievement indeed, and certainly contributes to literature the first published photographs of many of our native orchids. Each species is made the subject of a chapter, usually three or four pages long, which describes in charming fashion the adventures and experiences of the authors in finding it and gives a graphic idea of the rarity of many of them and of the difficulties which attend their discovery. Each chapter is headed by the English name of the orchid. It is pretty certain that some of these English names have been manufactured for the occasion and are not in ordinary use in the vernacular, but then it is no worse to manufacture an English name than a Latin one, and that we taxonomists do frequently. The

[1] Morris, Frank, and Edward A. Eames. Our wild orchids; trails and portraits. Pp. xxxi + 464. *130 pl.* New York, Charles Scribner's Sons, 1929. $7.50.

Latin name is given also, but is distinctly subordinated, and synonyms are thoughtfully omitted, for which we should all be grateful. The geographic distribution, favorite habitat, and soil preference of each species is also stated. In the preface a general view of the whole orchid family is presented, including flower structure, pollination, and classification, while an appendix is devoted to keys to the genera and species. The specific keys are based mostly on vegetative characters or the more conspicuous features of the flower and appear to be easy to work and quite satisfactory in results. The weakest feature of the book is its keys to genera, which utilize the usual technical characters of anthers and pollen-masses and will probably be found difficult by most amateurs. A strictly artificial key might easily have been provided, but after all such a key is scarcely necessary, since a cursory inspection of the plates should enable any one to refer his orchid to the genus or even to the species, while any doubt may be settled by use of the contrasting characters in the specific keys.

The authors deserve the highest praise for this happy result of what must have been a series of glorious botanical experiences.

H. A. GLEASON.

A BULLETIN ON "POLLINATION OF FRUIT TREES"

For a number of years, Dr. A. B. Stout, of the Scientific Staff of The New York Botanical Garden, has been coöperating with the Department of Horticulture of the New York State Agricultural Experiment Station in tests of the pollination requirements of the most important varieties of fruits grown in New York and in technical studies of the sterilities which are involved. The results of these studies have now been published by the Experiment Station in Bulletin No. 577 under the joint authorship of Richard Wellington, A. B. Stout, Olav Einset and L. M. Van Alstyne.

This bulletin presents a survey of the various factors involved in the setting of fruit, and discusses especially such types of sterility as pollen abortion and self- and cross-incompatibility in relation to the pollination problem in commercial fruit-growing. The results of many controlled pollinations are presented for the important varieties of apples, pears, cherries, peaches and nectarines grown in the State of New York. The results indicate that the apples, the pears, the sweet cherries and the Japanese plums are

as a rule decidedly self-fruitless, either from pollen abortion or from self-incompatibility. Also, in certain Duke cherries there is much pollen abortion. Between various of the sweet cherries and various of the pears (especially the Bartlett and the Seckel pears) there is also cross-incompatibility.

If the growers of these important fruit crops are to obtain maximum yields of fruits, there must be in many cases proper cross-pollination. This may be provided by the proper interplanting of varieties, the rules for which are presented in this bulletin.

It is especially noted that the ideal fruits from the standpoint of crop production are those that are self-fruitful, and that an important step to be taken in the future is the development of varieties by selective breeding that are pollen-fertile and highly self-compatible, and at least equal in quality to the present varieties that require cross-pollination. It is suggested that " in the breeding work with cherries, plums, apples and pears, self-fruitfulness may well be considered as equal in importance to the quality of the fruit."

PUBLIC LECTURES DURING MARCH, APRIL, AND MAY

The following is the program of the free illustrated lectures given at The New York Botanical Garden in March, April, and May. These lectures are in the Museum Building on Saturday afternoons, beginning at 3:30. Late-comers are admitted at 3:45.

March 1. " Ornamental Planting for Small Grounds," Prof. Hugh Findlay, Professor of Horticulture, and Landscape Architect.

March 8. " History and Culture of the Narcissus," Mrs. Wheeler H. Peckham, Honorary Curator of Iris and Narcissus Collections.

March 15. " Plant Life South of the Ice Front during the Glacial Epoch," Dr. Arthur Hollick, Paleobotanist.

March 22. " Some Peculiarities of the Gladiolus," Dr. Forman T. McLean, Supervisor of Public Education.

March 29. " Reproduction and Sex in the Fungi," Dr. B. O. Dodge, Plant Pathologist.

April 5. "Czecho-Slovakia," Dr. H. A. Gleason, Curator.
April 12. "John Burroughs," Dr. Clara Barrus, Author.
April 19. "The Origin of Civilization in Relation to the Origin of Cultivated Plants," Dr. Elmer D. Merrill, Director-in-Chief, The New York Botanical Garden.
April 26. "Birds and Their Vegetable Foods," Mr. Aretas A. Saunders, Ornithologist and Forester.
May 3. "Jamaica: Its Flora and Scenery," Dr. Marshall A. Howe, Assistant Director.
May 10. "Color in the Garden," Miss Grace Tabor, Author, Landscape Gardener and Garden Editor of the Woman's Home Companion.
May 17. "How Plant Research and Agricultural Machinery Increase Food Production," Dr. William Crocker, Director, Boyce Thompson Institute for Plant Research.
May 24. "Some Plants of Recent Introduction," Dr. B. Y. Morrison, Senior Horticulturist, Foreign Plant Introduction, U. S. Department of Agriculture.
May 31. "Travels Through the Mountains of Colorado, Wyoming, and South Dakota," Dr. Fred J. Seaver, Curator.

NOTES, NEWS AND COMMENT

Dr. A. B. Stout, Director of the Laboratories, gave an illustrated lecture on "Sterilities in Flowering Plants" on Friday afternoon, February 28, in Milbank Hall, Barnard College, under the auspices of the Barnard Botanical Club.

The New York Times of February 23 announces the retirement, effective June 30, of Dr. Henry Hurd Rusby as Dean of the College of Pharmacy of Columbia University, and of Dr. Robert A. Harper as Torrey Professor of Botany in Columbia University. Both have long been members of the Board of Scientific Directors and the Board of Managers of The New York Botanical Garden, Professor Harper being since 1916 Chairman of the Scientific Directors, in which important post he succeeded Dr. Rusby.

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Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 39,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

All requests for further information should be sent to

THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK CITY

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OF
THE NEW YORK BOTANICAL GARDEN

A COLLECTING TRIP ACROSS PERU
A. C. SMITH

PUBLICATIONS OF THE STAFF, SCHOLARS, AND STUDENTS OF THE NEW YORK BOTANICAL GARDEN DURING THE YEAR 1929

THE ALPHABETICAL IRIS CHECK LIST
MARSHALL A. HOWE

NOTES, NEWS, AND COMMENT

ACCESSIONS

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A COLLECTING TRIP ACROSS PERU

The vast region of the Peruvian "montaña"—the lowlands which lie in the Amazon drainage basin—is without doubt one of the richest sections of South America from a botanical standpoint. The tropical jungle which reaches from the Atlantic to the base of the Andes here attains its greatest luxuriance. In regard to the botany of this section, the names which immediately occur to one are those of Spruce, Matthews, and Poeppig, who in the middle of the last century made the first extensive botanical collections here. Their plants remain the basis of our knowledge of the region, but recent collectors have added much. Among them the names of Weberbauer, Ule, Tessmann, Macbride, and others have become well known to students of taxonomy.

With the intention of adding to the material in American herbaria, an expedition was sent last year, under the auspices of the Smithsonian Institution, to make general collections in the basins of the Ucayali, Marañon, and Huallaga rivers. The personnel of the expedition was Mr. Ellsworth P. Killip of the National Museum, Mr. William J. Dennis of the University of Iowa, and the writer, representing The New York Botanical Garden. Realizing that this vast field could by no means be covered in the time at our disposal, we left New York in March, 1929, with very flexible plans.

We proceeded via the Panama Canal directly to Callao, the port of Lima, the Peruvian capital. Formalities at the port were reduced to a minimum by the courtesy of officials, and soon we were located in Lima, ready to make preparations to proceed to the interior. Lima is a city of about 200,000, situated near the mouth of the Rio Rimac at the base of the Andes. The im-

mediate vicinity, and indeed the entire western slope at low altitudes, is dry and quite unproductive of plant life in variety. We thought it not worth while to do any botanical work here, and at the end of a week we were ready to leave the capital. This was a week of busy preparation, punctuated by visits to the famous

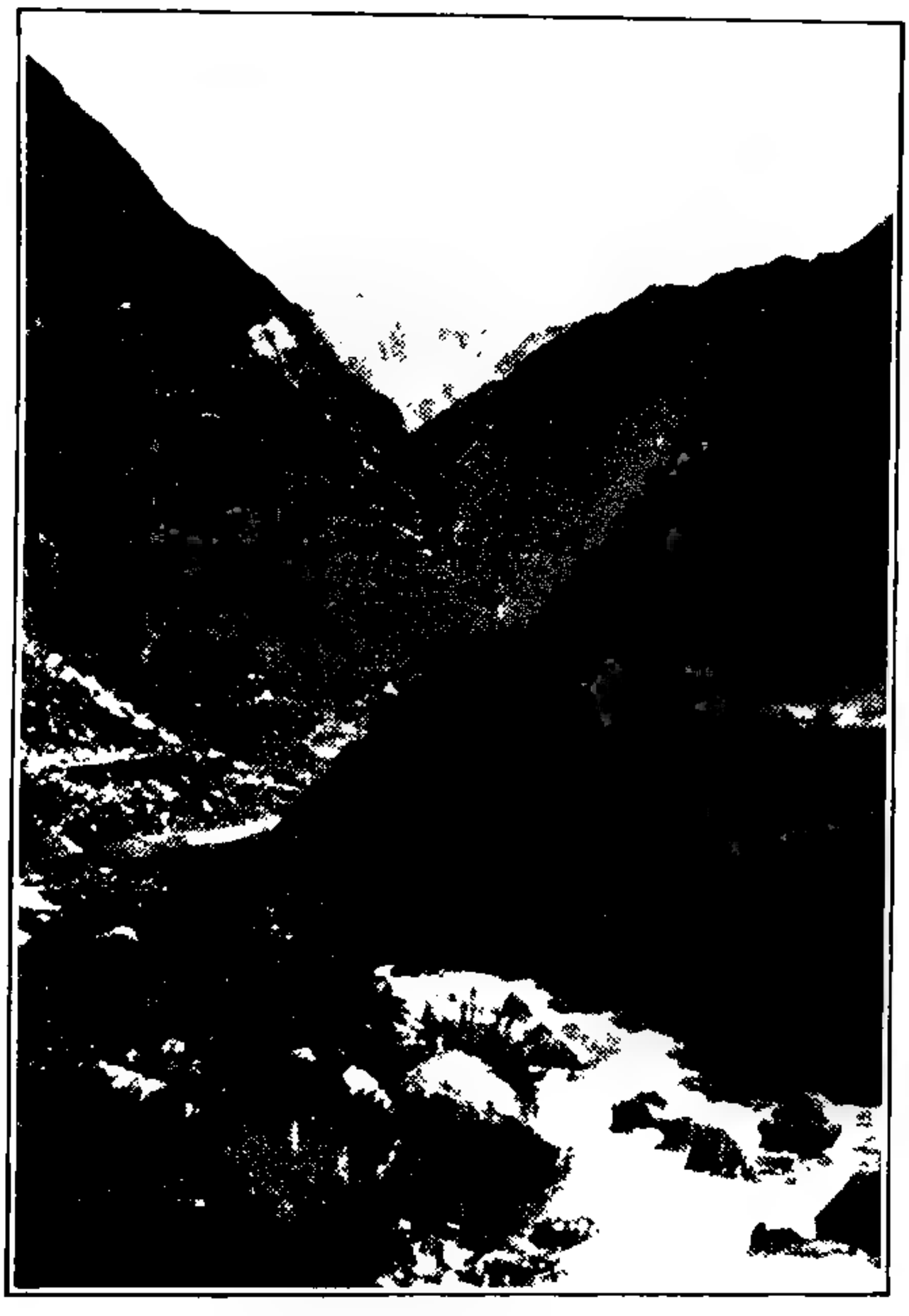

FIGURE 1. A valley on the western slope of the Andes.

cathedral, the University of San Marcos, the Museum of Archaeology, the modern Country Club, and many other points which give Lima such an appeal to tourists. Perhaps the most interesting contact we made in Lima was an acquaintance with Dr. August Weberbauer, whose collections form so integral a part of our knowledge of Peruvian flora. He gave us much useful ad-

vice concerning localities in the interior, and indeed there are few parts of Peru which one can visit without following the footsteps of this distinguished botanist.

The valley of the Río Rimac forms the gateway to the interior. Along this stream from its mouth to its source in glacial snow is

FIGURE 2. A family of Indians of the Campos tribe visit our camp at Kimpitiriki.

built the Central Railway of Peru, a piece of engineering work which one can only admire in awe. In a brief 171 kilometers of track it attains an altitude of 4776 meters, a height equalled by no other passenger road in the world. The train winds upward along startling precipices and among tremendous crags, passing through innumerable tunnels and often "side-stepping" by means

of switch-backs. The traveler is so impressed by this engineering feat that he is prone to neglect the gorgeous scenery. The lack of trees and large shrubs is a feature of the vegetation—in fact, as seen from the train, the country does not promise a profusion of material to the collector.

The opposite proves to be the case, however, if he stops off at one of the small towns. To break the trip "up the hill" and thus avoid the "soroche," the mountain sickness against which one is warned a hundred times, we spent two days at Río Blanco,

FIGURE 3. A glacier at 4700 meters altitude, Mt. La Juntay, near Huancayo.

a delightful little collection of huts at 3500 meters altitude. Here we obtained a representative collection of the many herbs and dwarf shrubs of the western slope. As usual at this altitude, the predominating flower color is yellow, a brilliant tinge being given to the landscape by many Calceolarias and Compositae. Among the less noticeable but still characteristic plants are Monninas, Valerianas, Lupines, Pitcairneas, and ferns of the *Cheilanthes* type.

Proceeding along the railway, we crossed the crest of the western range by a tunnel under the beautiful snow-capped peaks

and saw a tributary of the Amazon for the first time. The railway leads down a gentler slope to the mining town of Oroya, which lies at the base of the second range of the Andes. This central valley is a bleak and wind-swept *puna,* with a vegetation of grasses and prostrate mountain herbs forming a colorless and depressing landscape. Travelers (unless they are interested in copper) leave it at the first opportunity. We had been in Oroya only fifteen minutes when we again started off, this time in a dilapidated "camion," for Tarma. The road, with no prelimi-

FIGURE 4. Aina, a town at the junction of the tropical and subtropical zones.

naries, winds crazily up to the summit of the second range, which in altitude and grandeur is hardly less than the first. Then there is a long descent in the gathering darkness to the town of Tarma, which lies in a crowded little valley at 3100 meters altitude.

Making Tarma our headquarters for a few days, we collected in the surrounding countryside. The region is dry and too well cultivated to be of great value to the collector, but several Salvias, a Gerardia, and a few Cacti were of interest. The only tree which thrives at this altitude is the introduced Eucalyptus, stately rows of which form patterns on the hillsides.

Our plans had called for continuation in an easterly direction to the tropical valley of the Río Chanchamayo, but we postponed this for a month and traveled to the south. The town of Huancayo became our first objective. Mr. Dennis had spent several years in Huancayo, so we did not feel absolute strangers to its highland atmosphere, its surrounding ranges of bare hills, its streets crowded with Indians on market days. Making us feel more at home, were the American teachers at the Andine Institute and the scientists at the Magnetic Observatory of the Carnegie

FIGURE 5. Travel by land—our caravan on the Pichis Trail.

Institution. Mr. and Mrs. Paul Ledig, our hosts at the Observatory, made our visit to Huancayo a delightful one.

Our most interesting field trip in the vicinity of Huancayo was to Mt. La Juntay, the "Mountain of Perpetual Snow." Collecting at the base of the snow-line revealed many species of small herbs, such as *Castilleja, Werneria, Gentiana, Halenia, Bartsia,* and interesting grasses. The mountain is cut up into several peaks, resulting in the formation of various glaciers and beautiful series of small lakes. We each visited a different glacier and met again at dusk after the most enjoyable and exciting day of the entire trip.

Huancayo lies in the valley of the Mantaro river, which here has a southeasterly course. Eventually it makes a sudden turn, to flow in exactly the opposite direction towards the Amazon. Near this bend, on the small Río Huarpa, lies Huanta, which was to be our next headquarters. This is the center of an arid mountain region, at the base of the range of the Andes which separates the Mantaro and the Apurimac drainage. At Huanta we outfitted for our first mule trip, a rather difficult task because the peasants were celebrating the fiesta of "Labor Day," a condition in which

FIGURE 6. Travel by water—a difficult stretch of the Pichis River.

they will neither work nor allow their beasts to work. However, we prevailed upon "Señor el sub-Prefecto" to draft eight or ten mules for us, and with this motley outfit we started eastward over the mountains.

The range which divides these two large rivers reaches a height of 4500 meters. After three days' riding through an open, cold, and semi-cultivated country, spending the nights in tumble-down stone huts with hospitable but depressing Quechua peasants, we reached a subtropical climate and flora in the town of Aina. Here about ten huts are assembled in a tiny valley, whose orange trees and orchid-laden woods were doubly welcome after our

weeks in the mountains. Aina became our headquarters for a very profitable ten days. Mr. Killip collected in the vicinity of the town while Mr. Dennis and I proceeded two days farther east to the Rio Apurimac, over a very rough and muddy road. This part of the *montaña* is settled only at a few isolated spots, one of which is a Franciscan mission, Kimpitiriki. Here we were received with great kindness by the priests of the mission, and the following days we enjoyed our first real lowland collecting. Here we first came into contact with lowland Indians, whose civilization and physique form a sharp contrast with that of the descendants of Incas who inhabit the mountains. All the Indians we met on the trip were of a friendly and curious disposition, showing none of the head-hunting proclivities assigned to certain tribes of them.

Having made satisfactory collections in this part of the *montaña*, we retraced our route through Huanta and Huancayo to Tarma, where we made plans for our trip towards Iquitos, the capital of the Department of Loreto and the only town of importance in eastern Peru. The first stage of this trip, by auto, carried us down into the fertile valley of the Chanchamayo river. Here we spent a profitable month, with headquarters at the village of La Merced and at the Perene Colony, a large coffee plantation, where we were made welcome by the director, Señor Don Victor Valleriestra. Over a small range of territory in this region altitudes from 600 to 2000 meters are encountered, so that collecting is interestingly varied. Mr. Killip made a trip westward to Huacapistana, a locality made famous by Dr. Weberbauer, and doubtless re-collected many plants from the type locality. At the altitude of Huacapistana (1700 meters) such mountain plants as *Vernonia, Eupatorium, Lupinus, Thibaudia, Calceolaria,* and terrestrial orchids were much in evidence, while at lower altitudes in the Chanchamayo valley proper these gave way to an abundance of Melastomataceae, Rubiaceae, Piperaceae, Araceae, and a great number of ferns; among the latter, tree-ferns, large Diplaziums, and epiphytic Polypodiums were common.

From this part of Peru a mule trail leads over a low range to the navigable rivers of the Amazon system. This is the only route of any importance which connects Amazonian Peru with the central mountainous region. It is known as the Pichis Trail,

with a total length of about 200 kilometers and an altitude range of from 400 to 2000 meters. Towards the end of June Mr. Killip and I were ready to start this phase of the journey, while Mr. Dennis was to join us at the river port by airplane. More and more of the interior travel of Peru is being done by airplane, a method which saves weeks of time as well as the fatigue and discomfort of caravan travel.

FIGURE 7. A path through lowland forest.

The Pichis Trail is traveled twice a month by a mail caravan, but other travelers are few. We often went the entire day, seeing no one but our mule drivers and their weary charges. At intervals of 20 to 30 kilometers are placed "tambos" little inns which provide room to sleep and food of a sort. Reports as to the discomforts of these huts are greatly exaggerated; we found hospitality and pleasant surroundings at every inn. But, nevertheless, travelers other than collectors are advised to take the air route. The road winds endlessly around little spurs of the mountains, maintaining for the most part a very steady grade. The usual traveler doubtless finds it a very dull route, as every curve brings him up against a solid mass of green without variety. Scenery

is not comparable with the trails of the higher mountains, for on every hand is dense tropical verdure without open vistas. But it may be imagined that to us it was a trip full of exciting adventures, for we could not round a bend without finding on the other side some odd-appearing aroid, some *Piper* with unusual leaves, a bright-flowered *Centropogon,* or a rare orchid in a crevice of rock. So profuse and varied was the vegetation along the trail that it is difficult to name the outstanding families, but we agreed that the development of Gesneriaceae was perhaps the most remarkable feature. Near one of the inns we found a sphagnum bog reminiscent of the north, and supporting a flora quite distinct from the surrounding forest. Among the unusual plants which inhabited it were rare melastomes, Araliaceae, a *Cavendishia,* a *Weinmannia,* several *Xyris,* beautiful terrestrial orchids, and the common cinnamon fern of the north.

After eleven days along this trail we reached the terminus on the Río Pichis, a good *tambo* known as Puerto Yessup. The Pichis is a swift and narrow stream, very shallow in the dry season, as when we visited it. These headwaters, and in fact all the rivers of the Amazon system, have a tremendous rise and fall dependent upon the season, the variation sometimes being as much as fifty feet. For a week or two we slowly worked downstream, traveling in a capacious dugout canoe, and making headquarters at three very ideally located settlements—Puerto Yessup, Puerto Bermudez, and Cahuapanas, the latter a mission where we were the guests of countrymen. This method of traveling is the most delightful to be found in the tropics. The canoe is propelled along by leisurely Indian boys who are not prone to overwork in the tropical sun. Occasionally they stop to dynamite for fish or to take to the jungle in search of a troop of monkeys, stops which the traveler may use advantageously to collect along the shores. There is no need to spur on the crew, for the only goal is a sandbar jutting out into the stream, and until dusk clouds of sandfleas make camping unbearable. Fortunately these pests disappear with the sun and do not attack again until the traveler is on the river in the morning. Camping is a simple matter. There being little danger of rain in the dry season, cots are set up in the sand, a supper of fish, *yuca,* and turtle eggs is prepared by the

crew boys, and there is quiet until bands of howler monkeys roar at dawn.

Soon we gave up canoe travel and met the mail launch which carried us to Masisea on the Río Ucayali, the head of large river-boat navigation. On the very day we arrived here Mr. Dennis joined us, having covered by air in two and a half hours the route which took Mr. Killip and me a month. From this comparison it may be imagined that the mule trails are falling more and more into disuse.

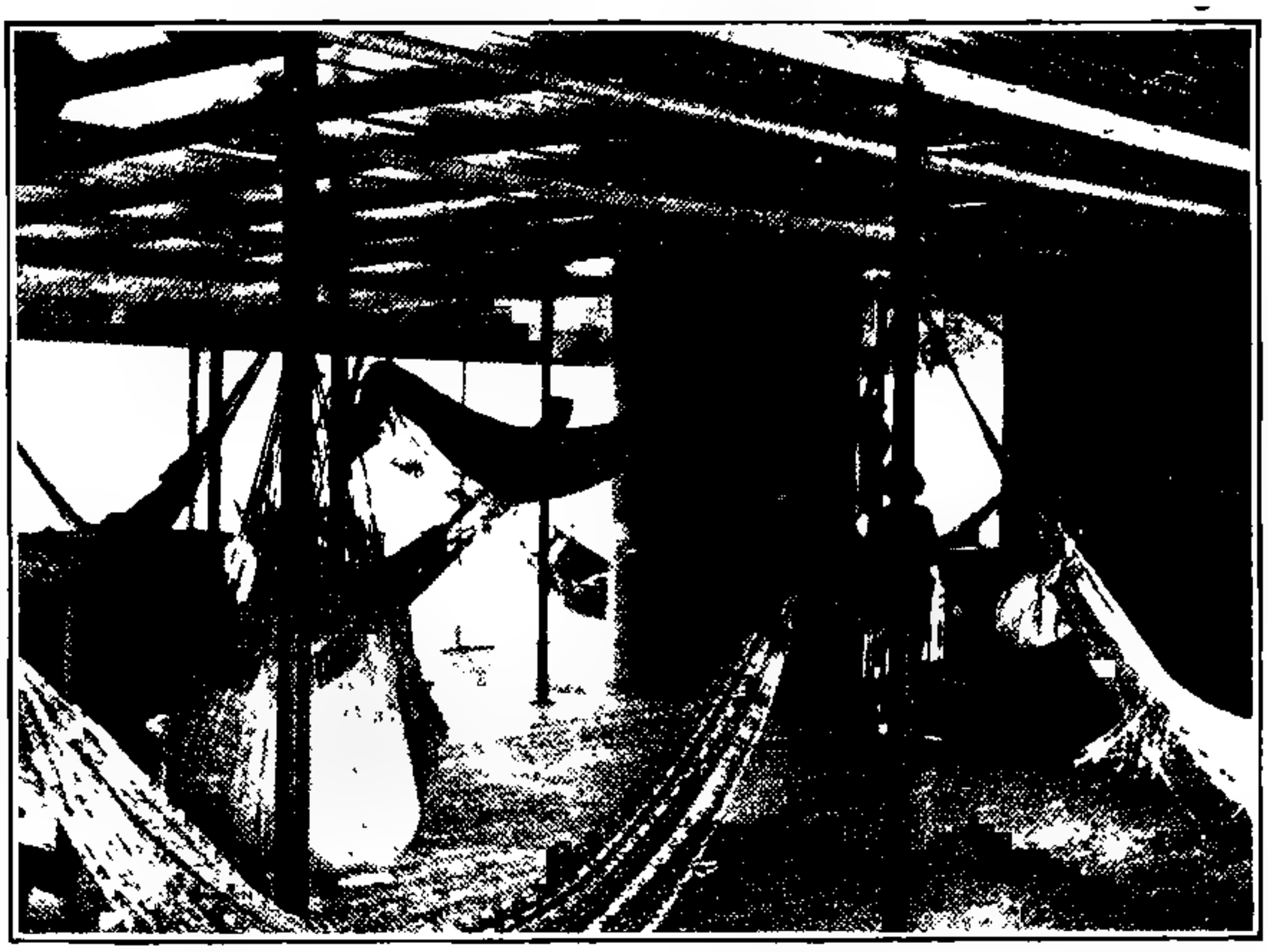

FIGURE 8. The deck of a river boat in the siesta hour.

In comparative luxury we continued the length of the Ucayali, past the point where it joins the Marañon to form the Amazon, to Iquitos, which lies about 70 miles below this junction. At this point the Amazon divides into two channels, on the narrower of which the town is located. Iquitos is a delightful little city, with an ideal climate (at least in the dry season) and inhabitants who are pleasant and helpful. Through the courtesy of Mr. Graham Ker, of the Standard Oil Co. of Peru, a house was put at our disposal, which served as living and working quarters during the rest of our stay in Peru, and from which we made trips of considerable length.

The last half of August and the first half of September were spent on the rivers above Iquitos. Mr. Dennis traveled on the navigable part of the Marañon and the Morona, while Mr. Killip and I made headquarters at Yurimaguas, a town on the Río Huallaga about five days from Iquitos. Collecting in this region proved very profitable. There is little variation in elevation, but a different flora is found in various habitats. Land which is inundated at high water is designated by the natives as "monte bajo;" this habitat supports a very distinctive flora, characterized by palms, Cyclanthaceae, Araceae, and large epiphyte-laden trees. The higher land, known as "monte alto," is the home of innumerable Rubiaceae, Melastomataceae, Anonaceae, Pipers, Euphorbiaceae, etc. Little knolls which rise out of swampy land along the rivers prove very excellent collecting grounds, from the points of view of both variety and abundance.

From Yurimaguas we made trips in several directions, Mr. Killip spending several days at Puerto Arturo and Santa Rosa, on the Río Huallaga, while I went westward to Balsapuerto, a village at the base of the mountains. Here a greater range of altitude was available, and collecting was reminiscent of the Pichis Trail. Six or eight months spent between the Huallaga and the Pacific would be very profitable; Yurimaguas would be an excellent starting point for such a trip, as from it such historic localities as Tarapoto, Moyabamba, and Chachapoyas can be reached. We had time to touch only the edge of this accessible region before it became necessary to return to Iquitos.

Before leaving Iquitos for the last time we made a short trip up the Río Itaya, finding a few days of excellent collecting along the shores of this narrow stream. A few years previously Tessmann had collected in the same region, and we attempted to re-collect some of his plants from the type locality. In Iquitos, by the kind permission of Dr. Harvey Bassler, of the Standard Oil Company of Peru, we had an opportunity to see a duplicate set of Tessmann's plants and to photograph some of them.

It was with regret that we left the pleasant little metropolis of the upper Amazon and started downstream. The river is navigable for ocean steamers of considerable size, a fact of which we took advantage by traveling to Manáos in the comfort of an English boat. Here Mr. Dennis went directly to New York.

while Mr. Killip and I stayed to collect near the city for a few days. In Manáos we had the good fortune to become acquainted with Dr. Adolfo Ducke, of the Museu Naçional at Rio de Janeiro, from whom we obtained much interesting and valuable information.

Unfortunately our time in Brazil was very limited. After Manáos, our only collecting was in the vicinity of Pará and at a few points touched by steamers on the lower river. The up-to-date atmosphere of these river cities—Manáos and Pará—cannot be overemphasized; one feels perfectly at home, and the sense of being an "expeditionist" is quite lost. After considerable delay we boarded a freighter, steamed out of the mouth of the tremendous Pará river, and were landed in New York two weeks later, at the end of November.

Summary of Collections

The total field numbers of the trip were about 9200, collected in three or four sets when possible. These were represented among important groups as follows:

Lower cryptogams	448	Melastomataceae	395
Filicales	927	Solanaceae	250
Araceae	264	Scrophulariaceae	121
Gramineae	209	Gesneriaceae	144
Orchidaceae	335	Acanthaceae	222
Piperaceae	531	Rubiaceae	574
Leguminosae	519	Compositae	423

A. C. Smith.

PUBLICATIONS OF THE STAFF, SCHOLARS, AND STUDENTS OF THE NEW YORK BOTANICAL GARDEN DURING THE YEAR 1929

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THE ALPHABETICAL IRIS CHECK LIST[1]

In preparing and publishing the Alphabetical Iris Check List, The American Iris Society has rendered a distinct service to both amateur and professional growers of these popular garden plants. Much briefer lists were published by the Society in its Bulletins 4 and 8 in 1922 and 1923. The earlier work in compiling check lists was initiated by R. S. Sturtevant, E. H. Krelage, and John C. Wister, but the present book has been brought to its completed form by its editor, Mrs. Wheeler H. Peckham, the Honorary Curator of the Iris and Narcissus Collections of The New York

[1] American Iris Society. Alphabetical Iris Check List. Edited by Mrs. Wheeler H. Peckham [Ethel Anson S. Peckham], New Rochelle, N. Y. Pp. 1–300. Baltimore, 1929.

Botanical Garden, with the coöperation of various other members of The American Iris Society. There is a brief introduction by the President of the Society, Mr. John C. Wister, and two pages of "Acknowledgments and Excuses" by the Editor. Following an outline of the systematic and color classifications of Irises, thirty pages are given to names and abbreviations of names of originators, introducers, etc., often with brief biographical sketches. After a list of 166 recognized natural species of the genus, comes the main body of the work, which includes not only the botanical species but also the names of garden varieties that the compilers have been able to find in existing literature. Following each name, in a condensed, abbreviated form, is a wealth of information, such as group and color classifications, name of introducer, date of introduction, references to literature, awards and citations, ratings, parentage, synonyms, whether extinct or superseded, etc. The style of type indicates whether a name is approved, a synonym, or uninvestigated. The treatment of the Japanese irises, descendants of *Iris Kaempferi,* is by Dr. George M. Reed, of the Brooklyn Botanic Garden. An interesting feature in this connection is an English translation of each of the transliterated Japanese names. Mr. B. Y. Morrison of the United States Department of Agriculture contributes two pages of illustration of the technique of making hybrids. Dr. B. O. Dodge, of The New York Botanical Garden, has a bibliography of Iris diseases and pests. There is an unsigned summary of directions for culture, and Mr. John Ravel, long with Mr. Bertrand H. Farr, has added a short chapter on "Nursery Practice—How to Grow Eighteen Acres of Irises." The book has been attractively made by the Waverly Press of Baltimore.

MARSHALL A. HOWE.

NOTES, NEWS, AND COMMENT

The firm R. Vincent, Jr., and Sons Company, of White Marsh, Maryland, has recently presented to the Garden ten plants each of ten of the newer and better clonal varieties of Pelargonium, and also ten plants of the Abutilon "Eclipse." These plants will be propagated for use in experimental studies and for general display in the Garden.

Dr. G. W. Martin, of the University of Iowa, spent the month of March at The New York Botanical Garden working over the slime-mould collection. Dr. Martin is collaborating with Professor T. H. Macbride on a revision of his slime-mould book and is planning later to monograph the group for North American Flora.

Mr. John T. Scheepers has recently presented to the Garden a case of 100 bulbs of *Lilium auratum*, collected from wild plants in Japan, and ten bulbs of the same sort have come as a gift from Mr. T. A. Havemeyer. Ordinarily some of the plants grown from commercial bulbs of this species possess the virus disease which readily spreads to healthy plants, causing much loss of plants in the garden. It is the hope that bulbs of wild plants will give plants free from this very destructive disease.

Among the visitors who enrolled in the library during the winter were the following: Dr. E. P. Felt, Stamford, Conn.; Mr. P. L. Buttrick, New Haven, Conn.; Prof. K. M. Wiegand, Ithaca, N. Y.; Dr. Francis W. Pennell, and Prof. J. R. Schramn, Philadelpiha, Pa.; Mr. W. W. Eggleston, Washington, D. C.; Prof. Shigeo Yamanouchi, Chicago, Ill.; Prof. Frederic T. Bioletti, Berkeley, Cal.; Mr. and Mrs. Edgar L. Marston, Los Angeles, Cal.; Mr. I. L. Conners, Ottawa, Can., and Prof. Eichi Hirano, Tottori Agricultural College, Japan.

Drs. E. D. Merrill, A. B. Stout, J. H. Barnhart, H. A. Gleason, and B. O. Dodge have been delegated to represent The New York Botanical Garden at the Fifth International Botanical Congress, to be held in Cambridge, England, August 16–23, 1930. Dr. Merrill is a Vice-president of the Congress and, with Director-Emeritus Britton, is also one of the Vice-presidents of the Section on Taxonomy and Nomenclature. Drs. Merrill, Stout, Gleason and Dodge will present papers. Dr. Barnhart is one of the four American representatives on the International ad interim committee on the nomenclature of plants.

The Charles Lathrop Pack Forest Education Board, 1214 Sixteenth Street, N. W., Washington, D. C., announces the establishment of a number of fellowships to "gifted men who demonstrate natural powers of intellectual and personal leadership and

who intend to make forestry their life work." . . . The amount of the fellowship grants will be determined by the circumstances of the individual cases. Generally speaking, the fellowships will range from $500 to $2500. In special cases, a higher sum may be authorized by the Board."

Dr. A. J. Grout, who has been for some years Chairman of the Department of Natural Science of the Curtis High School of Staten Island, retired in February from active connection with the public school system of the City of New York. He will continue his studies of the North American mosses and will keep up his connection with the staff of the Biological Laboratory at Cold Spring Harbor on Long Island. Dr. Grout expects to attend the International Botanical Congress in Cambridge, England, in August. He is a member of the international committee on the nomenclature of the bryophytes.

Mr. Maturin Livingston Delafield, a member of a distinguished New York family and life member of The New York Botanical Garden, died on December 18, 1929, at the age of 60, in Lausanne, Switzerland. He was a graduate of Columbia University in the class of 1893. He was Librarian of the Torrey Botanical Club for four years (1889–1892) and was its Treasurer for three years (1898–1900). In 1899, Mr. Delafield became the first Patron of The Botanical Society of America, a distinction that he later shared with Mr. J. P. Morgan and Dr. and Mrs. N. L. Britton. Ill health led to his early retirement from business, after which he lived abroad, chiefly in Switzerland.

Meteorology for February. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 49½° on the 2nd; 54° on the 3rd; 48° on the 13th; 73° on the 20th; and *75° on the 25th.* The minimum temperatures recorded were: 11° the 6th; *2° on the 16th and 17th;* and 15° on the 18th. The total precipitation for the month was 2.61 inches which includes a 3-inch snow figured as .30 inches of rainfall. Traces of snow and sleet fell on the 17th, the 10th, and the 27th.

Meteorology for March. The maximum temperatures recorded at The New York Botanical Garden for each week or part

of a week were: 55° on the 6th; *65° on the 13th;* 57° on the 20th; and 58° on the 25th. The minimum temperatures recorded were: *17° on the 3rd;* 20° on the 4th; 21° on the 15th; 18° on the 22nd; and 30° on the 28th. The total precipitation for the month was 1.70 inches. There were traces of snow during the night of the 2nd and during the morning of the 27th.

ACCESSIONS

LIBRARY ACCESSIONS—SEPTEMBER, 1929 (CONTINUED)

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BRONX PARK, NEW YORK, N. Y.

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JOURNAL
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COTTON
H. H. RUSBY

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H. A. GLEASON AND A. C. SMITH

GROWING EXHIBITION FLOWERS
JAMES STUART

NOTES, NEWS, AND COMMENT

ACCESSIONS

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COTTON

Cotton consists of the hairs growing on the surface of the seeds of the cotton plant. It is therefore not a fiber, although usually so designated, since fibers are structures growing in the interior of the plant tissue and forming a part of its skeleton. Appendages upon the surfaces of the plant are technically called trichomes. These trichomes have many other forms, such as scales, warts, and prickles. Those of cotton consist of very long hairs, of peculiar structure. As viewed with the microscope, they begin to grow when the seeds are very young and continue to lengthen until near the time of maturity of the seed. As the first ones lengthen, others are produced, so that when the seed is mature, it bears hairs of various lengths. The longer these are, the more valuable is the cotton, but the shorter ones, known as linters, also have many uses. As the hairs elongate within the seed pod, it becomes impossible for them to retain their straight position and they become crowded and tangled in a matted mass. By their pressure, they assist in causing the ripened seed pod, the cotton boll, to split open. Thus released from pressure, the cotton expands and forms a fluffy white mass, which soon makes its escape from the pod. Viewed at this time, the cotton entirely conceals the seeds, which occupy the center of the mass.

As soon as convenient after the bursting of the pods, the cotton is picked. The object in this work is to remove the mass of cotton from the boll in an entire condition, at the same time avoiding the taking of portions of the pod, or of other foreign matter. The operation is a tedious one, and is performed chiefly by the negroes of our southern states, who become very skillful and rapid in harvesting the crop. There is great competition among them in the

performance of this work and prize contests frequently occur. Many attempts have been made to invent a machine which would successfully pick the cotton crop. The difficulty of producing such a machine is apparent when we consider that the cotton plant is several feet high and wide and much branched, the bolls being scattered about on all parts of the branches. In spite of this difficulty, a number of machines have been invented and one of them is so efficient as to have come into common use in some sections.

The cotton thus gathered is loaded into wagons and taken to the factory, where the seeds are removed. It was a great day for the cotton industry when the machine known as the cotton-gin was invented for the performance of this work, which previously had been done altogether by hand. The hand process was so slow and the amount of work performed so small, that it would have been a practical impossibility to have supplied enough cotton to meet the world's present demands by that method. The cotton-gin consists of several very small circular saws mounted close together on a shaft and rotating with great rapidity. As there is only room for the seeds to pass between the saws, the result is that the cotton is cut loose. It is carried by a current of air from the fanning machine, while the seeds are dropped into their own receptacle.

One of the interesting sights to be seen at a cotton-gin is the unloading of the huge wagons. A long tube with an open mouth is let down from the warehouse to the wagon and by means of a suction pump the cotton is drawn into this tube and carried up into the warehouse. After being ginned, the cotton is packed into bales, the bales being made very compact and hard through the application of hydraulic pressure. From each bale a large sample is separated, and from the character of this sample, the quality and price of each bale are determined. Thus, in every warehouse where cotton it offered for sale, there are huge cases containing thousands of these samples. The cotton is classed in different grades, according to its color, toughness, and strength, freedom from impurities, collection without exposure to weather, and especially the length of its fiber. The fiber is known as the " staple," so that the cotton is graded as long, short, and medium staple. The cotton grown along the coast and known as Sea

FIGURE 1. The Acala variety of upland cotton, growing in the Coachella Valley, California. Approximately one million acres of this variety are grown in the irrigated valleys of the southwestern United States. Photograph used by courtesy of the Bureau of Plant Industry of the United States Department of Agriculture.

Island cotton has the longest staple. The classification is carried much farther than is indicated by the three terms mentioned, the actual length being stated on a card attached to each sample thus, $\frac{7}{8}$ inch, $1\frac{5}{16}$ inch, 1 inch, $1\frac{1}{16}$, $1\frac{1}{8}$, and so on.

The special character and quality of cotton depend in part upon the species or variety of the plant producing it. The true cottons all belong to the genus *Gossypium,* of the family Malvaceae, the family that provides our hollyhock and marshmallow plants. It is commonly believed that two of the cultivated species of *Gossypium* originated in tropical America and one in tropical Asia, but we can not be sure that they are not all of old world origin. There are differences of opinion also regarding the botanical names of the species. The common upland or short staple cotton of our southern states is commonly regarded as *Gossypium herbaceum* L.; other cultivated species are *G. arboreum* L. and *G. barbadense* L. By hybridization, new cultivated varieties have been produced.

Not all cotton is white, various shades of tan or brown being produced. Egyptian cotton is of this color, and white varieties, when cultivated in Egypt, have a tendency to produce brown staple after several generations, so that most of the Egyptian product is grown from seeds imported from the United States.

The cotton plant is subject to various diseases. It will not stand freezing, and great loss is often incurred through the occurrence of late spring frost, after the cotton has begun to grow. One of its greatest enemies is the boll-weevil, an insect that is hatched from eggs deposited in the young ovary of the flower. As the cotton develops, it is eaten and cut by this insect, which destroys its staple. As a result of its varied botanical origin, place of growth, climatic conditions, and care in collecting and preserving, commercial cotton presents numerous and varied characteristics.

Each of these different grades has been experimented with until it has been found to be especially useful for particular purposes, so that manufacturers of different kinds of cotton goods have come to make use of certain grades of cotton for their special purposes. Not only is this true, but much study has been devoted to securing special results by the blending of different grades of cotton, so as to produce a net result which could not be produced by the sole use of any one grade.

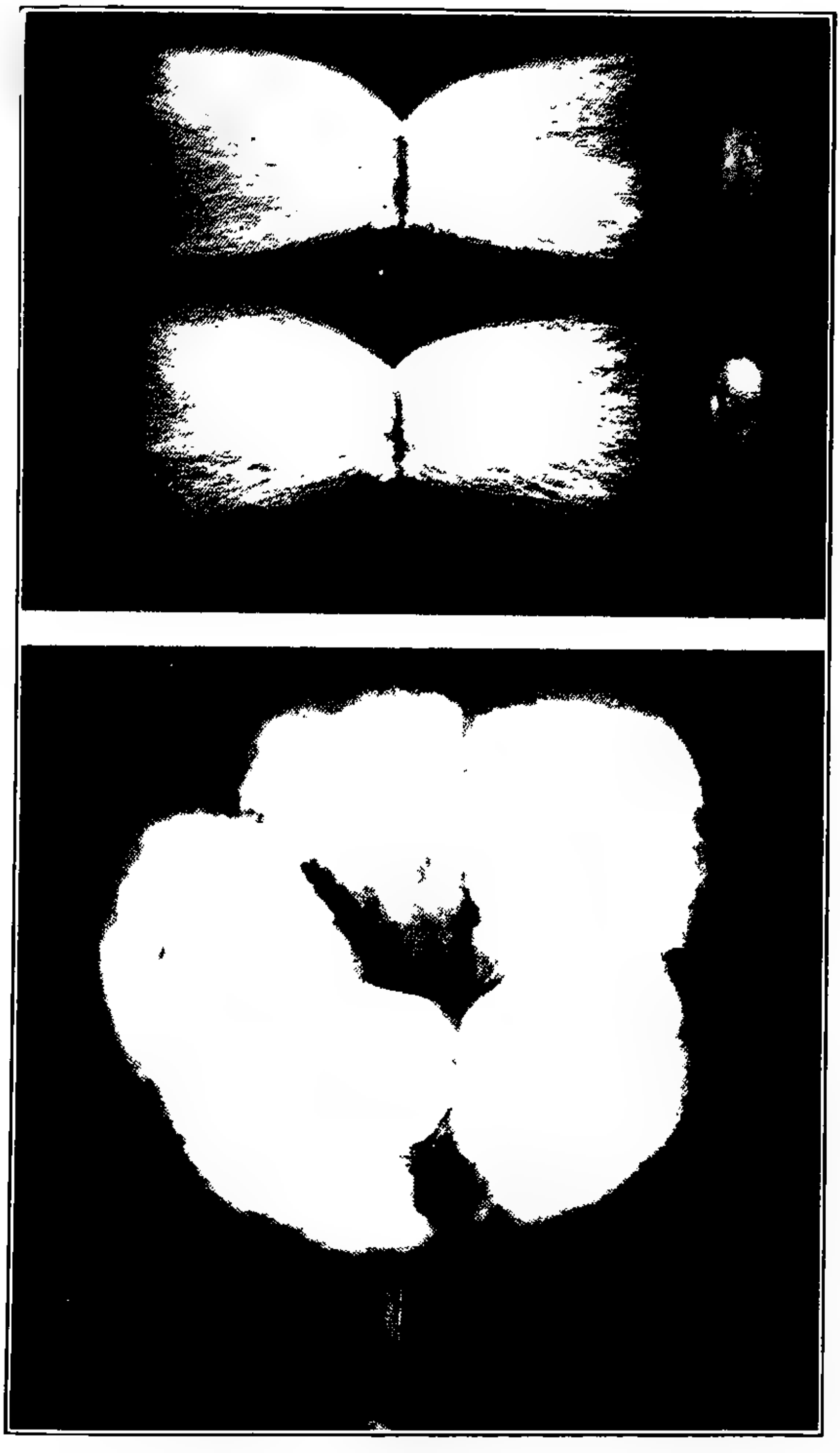

FIGURE 2. The lower photograph shows an open boll of the Acala variety of cotton, natural size. The upper shows the combed staple and ginned seeds of the same variety, natural size. The photographs are here used by permission of the Bureau of Plant Industry of the United States Department of Agriculture.

This blending of the cotton is performed in various ways. By one method a bale is opened and spread out upon the floor in a thin layer, another bale of different grade is then spread out upon the first and this process is continued until the required mixture is obtained. A cutting machine is then used, by which a slice of this cotton is cut off from one side of the pile, the mass thus taken being a pretty uniform mixture of the whole. By another method, different kinds of cotton are put in different receptacles and a strand from each is drawn out through a suitable opening, these strands being then brought together and wound upon a cylinder. By a repetition of this process, a mixture may be obtained which very perfectly combines the qualities of the different grades used.

In the preparation of the cotton for use, the first process is that of removing all the impurities, such as fragments of leaves, pods, etc., this process being known as carding. The process of spinning consists in the twisting of the cotton hairs together to form a thread. These threads are, of course, made of different sizes, according to the amount of cotton used in the process. If the cotton thread or yarn thus produced is to be used for weaving into cloth, a thread or yarn of a certain kind is to be obtained. If darning cotton is desired, the thread is of a relatively large size and soft finish, but if sewing thread is to be made, the object is to get it as strong and hard as possible, and a smooth surface is very desirable. There is a great question whether modern methods of cotton spinning has, on the whole, improved the quality of sewing thread. The principal object of the modern manufacturer is to produce an enormous amount of thread in short time and at low cost. The results of his attempts in this direction have been to furnish the world with cotton thread at extremely low cost as compared with the product of hand work, on which the world formerly depended. It is doubtful, however, if the quality of this machine-made thread is, all things considered, as good as the best of the hand-made thread which was in use half a century ago. One of the original defects in machine-made thread was the projection from it of short ends of the cotton fibers, thus giving to the thread a rough or somewhat shaggy appearance, and a great deal of study and experiment was devoted to removing this defect. A method commonly in use is that of causing the thread to pass

through a thin mixture of some fine white powder in water, which causes the adhesion of these projecting ends and gives a fine glossy appearance to the thread. If carefully done, only a very minute amount of the substance is necessary to produce this result, but in some of the cheaper grades of manufacture, the amount of this mineral matter is greater than necessary, and imparts to the thread a false appearance of good quality.

As has already been said, the quality of any product manufactured from cotton will be better when the longer staple grades are used.

It will be seen that in the process of separating these long threads from the mass there must result a very considerable amount of cotton composed of linters and of short pieces, resulting from the ginning process, from the ravages of the boll-weevil, and from other causes. None of this material is wasted, since various uses can be found for cotton, which depend upon the chemical nature of its substance, rather than its mechanical perfections. The substance composing cotton hairs is about the purest form of cellulose that is known to exist in nature; at least, it is the purest form which is obtainable in large commercial quantities. One of the important uses made of this material is for the manufacture of gun-cotton, which is enormously used as an explosive in war. This is made by soaking the cotton, by special process, in nitric acid. The acid enters into combination with the cellulose, the product therefore known as nitro-cellulose. This substance in turn finds use in medicine, a solution being made from it, in a mixture of alcohol and ether, which, applied to the skin, evaporates and leaves a thin elastic coating upon the surface, thus protecting raw surfaces resulting from injuries, such as burns, scalds, or abrasions. This substance is known as collodion. It is, of course, very inflammable and even explosive, and its use in the household calls for careful storage and preservation.

The uses made of the cotton seed are entirely different in character from those of the cotton, and some of them are very surprising, as to the results obtained by the various manufacturing processes. This subject calls for separate treatment.

H. H. Rusby.

METHODS OF PRESERVING AND ARRANGING HERBARIUM SPECIMENS

So many requests for directions for collecting reach the Garden that the following paper has been prepared to cover the subject in general. It is based on the experience of the staff in collecting in small and large quantities, in the temperate and in the tropical zones, and while on the march in difficult country as well as while working from a fixed base.

The essential features of preparing plants for scientific specimens and for botanical study are their preservation by drying and convenience for storage and examination by pressing. The two processes are carried on together. Since a plant consists of many organs, often repeated indefinitely in number, such as the leaves and flowers, it is necessary to have some of each preserved, not merely separately, but in such a way as to show their relations to each other. It is therefore desirable to secure whole plants whenever possible and representative parts of plants too large to be preserved as a whole. For such large plants, and others which may greatly change their appearance in pressing, supplementary notes or photographs are extremely useful. The methods used in preparing specimens depend partly on the use to which they are put and partly on the quantity to be collected. The mycologist, collecting leaves infected with fungi, may slip a single flower between the pages of his notebook for identification; the tourist who wants to preserve a pretty flower simply as a memento may press it in a book; the amateur may press a dozen plants between newspapers and pile books on them for a weight, while one going into botany in a more extensive way may wish to take advantage of every possible means of increasing his output and reducing his work.

Collecting

From the very beginning of his preparation the collector must have his ultimate end in view—that is, the finished herbarium specimen. It is obvious that in order to have the specimen neat, it must be, in the first place, of more or less the correct size. This is a matter which depends upon the plant, and the problem of how much or how little to collect is one which recurs with each specimen.

Of small plants—that is, herbs up to about three feet in height—complete specimens are preferable to portions. A stem may be bent into several divisions without being broken, and thus the entire organism will be at the hand of the ultimate student. Roots should always be included in the specimen if possible. Of very small plants, such as those which grow in mats or small clumps, it will be necessary to have several specimens on a sheet if the appearance is to be complete. In the case of large herbs where the entire plant cannot be folded to the size of a herbarium sheet, it is advisable to collect the flowering and fruiting portions, leaves from the lower part of the stem, and the roots.

Of woody plants it is obvious that such complete specimens cannot be obtained. Hence it falls upon the collector to choose the most important parts for his specimen. Terminal branches with flowers or fruits or both are of great importance, since upon these organs the taxonomic position of the plant rests. The possibility of his plant having imperfect flowers must be kept in mind by the collector, as it is desirable to have both staminate and pistillate flowers, although these may be found on different parts of the same plant or even on different plants. In addition to the terminal portions, leaves should be collected from the lower parts of branches, particularly if these vary in shape or size from those of the upper parts. Occasionally it is desirable to collect a specimen of the roots, if these have a known or possible economic value. Mature seeds or fruits are always of value, and are frequently obtainable from the ground below the plant; in a similar manner wilted flowers may sometimes be obtained when fresh ones are not found. In such cases much care must be taken that the parts found on the ground really belong to the plant in question.

Equipment. Considerable equipment is necessary in order to collect efficiently and rapidly. Perhaps the article of greatest value is a pair of ordinary pruning shears, with which one can obtain branchlets of any reasonable thickness with a minimum of effort. A knife is far less efficient and will usually leave frayed strands of the wood, which is cut cleanly with shears. The advantage of shears in the case of spiny shrubs and trees is obvious. In obtaining roots a trowel may be used, but for convenience a stout hunting knife will accomplish the same purpose, although,

to be sure, it will not long retain its edge. A small supply of sacks is useful in collecting loose fruits, etc.

Transportation. The problem of transporting specimens from the field to the base where they are to be dried is best met by the use of a wooden portfolio with a shoulder strap. Within this are sufficient signatures of paper—about the size of folded newspaper—and a supply of blotting-paper dryers to last for the field trip. Each specimen is placed between two sheets of paper with whatever notes are desirable, and as soon as the press is too full for convenience a bundle is made by using two of the driers. Each bundle should be numbered so that the plants may be worked over at the base in the order they were collected, thus keeping the freshest ones until the end as well as recalling any mental notes. Some collectors prefer to use a *vasculum,* a metal box with a shoulder strap, a method which keeps the plants in a fresher condition but which is impractical with large collections.

Notes. The matter of field notes is of great importance, for it can readily be seen that an excellent specimen, if unaccompanied by descriptive data, is of absolutely no value. There are various ways of keeping such records, and each collector will find methods to satisfy himself. Many collectors make no notes at the actual time of collecting, but depend upon their memories while putting the plants in press, taking this opportunity to make written notes. But in making collections on a large scale this is not advisable, unless the entire plant is obtained and the flowers are such as need no descriptive notes. A record should be obtained of the habitat in which the plant is found, its height, method of branching, etc., the color of its flower parts and fruits, its native name if possible to obtain, its economic uses, etc. In the case of trees and shrubs it is sometimes advisable to describe the character of the bark (unless a strip is actually collected), the shape of the trunk, distribution of branches, etc. Photographs of individual plants are of value in the case of trees and some shrubs, and photographs of detailed features, such as expanded flowers, fruits, and bark, are also desirable. A photograph of a special habitat in which a group of plants are associated may be found interesting.

In addition to these notes which concern the individual plants, it is also necessary to add some general information which is true

of several plants and often of a whole day's collecting. Such notes are not necessarily made in the field, but may be placed in the collector's note-book whenever necessary. They should incorporate the locality, the elevation above sea-level, the date of collection, and the habitat (when this remains constant for a series of specimens).

Some arrangement is necessary to associate the specimen with its data. Most collectors prefer to carry a small note-book in the field, in which the data are entered under the collection number and the number placed in some way with the specimen. For instance, the number may be written on the sheet of paper on which the specimen lies, or it may be written on a small slip and inserted with the specimen, or a small tag may be numbered and tied directly to the plant itself. Another method is to write the notes on individual slips of paper which are then placed with the specimens and kept with them through the entire process of drying. However, it is generally safer to transfer all field notes to a larger permanent book while putting the plants in press. At this time notes can be elaborated and definitely tied up with the collector's number.

Preservation

The essential feature of preparing specimens is their preservation by drying and their flattening into a small bulk by pressing. Bulky or hard parts, such as nuts and other large fruits, fragments of bark, or pieces of wood must be dried without pressing. By their very nature, they are also resistant to attacks of insects or molds and require little protection against them. Such parts are best stored temporarily in paper sacks, accompanied by their labels or numbers, and packed in boxes for shipment.

Outfit needed. Presses. Presses are best made from tough but fairly flexible wood, cut into slats 1–1½ inches wide and ¼ inch thick, firmly nailed into a lattice 12 by 18 inches, with six slats running crosswise and four lengthwise. A pair of such lattices is used for each press. Pressure is best applied to presses by two straps or ropes, tied around the press about 3 inches from each end. Straps should not have a buckle, but should be provided with automatic catches by which they may be secured at any point; ropes should be fastened by as simple a slip knot as possible, so that they may be untied easily and quickly.

Driers. Thick blotting paper, or better, regular botanical drying paper, is used to absorb the moisture from the specimens while in press. This is cut to the same size as the presses, or a trifle smaller. Driers may be obtained from any dealer in botanical supplies.

Pressing paper is used to hold the specimens while drying. Newspapers are perfectly satisfactory. When pressing plants in quantity, time is saved by ordering newspaper stock from any paper-dealer, cut to the proper size. Pressing paper is used either as single sheets, cut to 11 by 16 inches, or as double sheets, cut to 16 by 22 inches and folded to 11 by 16. Both single and double sheets have their advantages and either may be used, depending entirely on personal preference; the former saves bulk and the latter probably gives greater protection to the plants, both during and after pressing.

Corrugated boards. For pressing plants in quantity, or for use in wet climates, especially the tropical lowlands, corrugated boards and artificial heat are almost indispensable. The boards may be used either single-faced or double-faced, with the corrugations exposed on either one or both surfaces. Double-faced paper is not easily procured, while single-faced paper may be purchased in rolls from wholesale paper-dealers. The boards should be cut to the size of the driers, if single-faced, or to twice that size and then folded once if to be used double-faced. The corrugations should in every case run crosswise the boards.

Corrugated boards may be used to advantage in dry climates without artificial heat, but in wet climates or whenever time is a consideration artificial heat is advisable. Screw-eyes are inserted in each pressing frame near the ends of one side, and the press and plants within it suspended by cords about two feet above the floor. A small kerosene stove is lighted beneath it, and the heat, passing through the corrugations, dries the plants in a short time. To confine the ascending hot air to the presses, a skirt of muslin is wrapped around the press and reaches to the floor. Small weights placed on the bottom of the skirt, where it lies on the floor, or a roughly circular frame of chicken-wire, prevent the muslin from blowing against the stove and minimize the danger of fire.

Pressing. Having returned from the field with plants, the next task is to put them into press. Have before you on a table within easy reach a pile of driers, another of pressing paper, and frames, straps or ropes, and labels, note-book, and pencil as needed.

Lay down a pressing frame with the lengthwise strips down. On it lay two driers, and next one pressing paper. On this ar-

FIGURE 1. A method of suspending the corrugated-board press over artificial heat.

range the first specimen to be pressed. Straighten out the leaves into approximately natural position and see that both lower and upper surfaces are exposed. See that the flowers or fruits are not obscured by the leaves, if possible. Bend long stems sharply, or large leaves when necessary, and see that no parts project beyond the edge of the paper. See that the plants are not too crowded and bulky; on the other hand ample quantity should be used on each sheet. Several small plants of one species may be

pressed together and are usually desirable to make a "good specimen." See that material is well distributed over the sheet to avoid getting too much bulk into the middle of the press. Be sure that at least one of the plants has its string tag attached, or that each pressing paper has its field label, or that the appropriate field number is plainly written near the margin of the sheet. A plant without its label is generally useless, and experience teaches that

FIGURE 2. Opening the press to remove the dried specimens.

the memory can not be trusted. When these matters are attended to, fold over the other half of the paper, if double sheets are used, using one hand for this while the other retains the plant in position; and place a drier on top of it; if single sheets are used, add a drier directly on top of the plant. Continue this process until about 30–50 plants are in the pile, then add two driers, and a pressing frame with the longitudinal strips up. Place the straps or ropes around the press and tighten by hand. Put the whole

press on the floor, stand on it, and again tighten the straps as tightly as possible.

Various small details of arranging the plants will occur which are best solved by experience, but certain features may need special mention. Flowers are often necessary for dissection later, and a number of loose flowers may well be added to each sheet. Delicate parts, separated from the rest of the plant, may be folded carefully between small pieces of thin paper and the latter included with the rest of the plant. Fleshy leaves, which are apt to be very slow in drying, may be scored in several places with the point of a knife. Joints of cacti are best reduced to sections by careful cutting. Stems with very dense foliage may be split lengthwise and half only used for a specimen. Sometimes even large leaves may be divided lengthwise into two. There is no necessity for limiting a single species to one sheet; the size of the leaves or flowers may necessitate that the plant be divided and pressed in two sheets or even more. The ultimate aim is to provide a usable and complete specimen, and whether several plants are pressed on one sheet, or one plant is divided over two or more, depends on the size and nature of the plants themselves. Quantity of material is always a desideratum, but quantity must never be subordinated to quality. The perfect specimen will show not only the various features of the plant but will also provide ample material of flowers or fruits or both for dissection.

Changing driers. After plants have been under pressure for 12–24 hours, the original driers will be too damp to be of further service and must be replaced by fresh ones. Provide a pile of dry driers, unstrap the presses, and transfer each pressing paper to a new press in which the fresh driers are used. If single-sheet pressing paper is used, take care that the plants are not broken or disarranged by abrupt removal of the wet driers. Restrap the press as before, and spread the wet driers in the sun to dry. This process of changing driers must be repeated daily until the plants are fully dry (see below), and may take from two to ten days, depending on the nature of the plants.

Use of artificial heat. When corrugated papers and artificial heat are used, the processes of pressing and drying are more or less separated. After 12–24 hours under heavy pressure, the plants are as flat as necessary. Now replace part of the driers

by corrugated boards, so that each plant, in its pressing paper, is in contact with a drier on one side and the grooves of a corrugated board on the other. The drier serves to keep the plant flat, instead of corrugating it to match the grooves on the board. If single-faced boards are used, driers may now be dispensed with entirely, but the boards will not last so long. If double-faced boards are used, half of the driers will be taken out for further use in pressing. Wet driers do not need to be dried in the sun, but may be used immediately for further pressing, while the wet driers returned to the press will be dried by the artificial heat.

The press with the corrugated boards may be filled until it is 12–18 inches thick. Much pressure is no longer necessary, since only the drying process remains. Hang up the press, attach the muslin cloth, light the kerosene stove, and the majority of the plants will be completely dry after 12–24 hours. Proper precautions against fire should of course be taken.

When are the specimens dry? Before the specimens are completely dry, they usually feel cool or moist to the touch, especially to the back of the fingers. A better test is to bend a leaf double. If the midvein snaps sharply and suddenly, or if the whole tissues breaks sharply, the leaf is dry and the stem is usually dry also. Fleshy stems sometimes retain their moisture after the leaves are dry and may need special examination.

Quantity of supplies needed. In preparing for a collecting trip, provide in advance as many pressing papers as are expected to be used. Since pressing without artificial heat requires about a week at an average, and one pair of frames will hold about 50 specimens, provide seven times as many frames as may be needed to hold a single day's collections. One person can rarely handle more than 150 specimens in a day, and can seldom average more than 80, so that 12 pairs of frames will be sufficient. By the seventh day some 560 plants will be in press, requiring as many driers, while the same number will be daily spread out to dry. The total number of driers will therefore approach 1200. In drying with corrugated paper, 48 hours will be the average length of time and a press will hold far more plants; driers will also be in continuous use. For an average of 80 plants per day, 5 pairs of pressing frames, 120 double-faced corrugated boards, and 200 driers will be sufficient. If experience shows that one can

collect plants more rapidly, or if there may be occasions when the use of artificial heat is not practicable, larger quantities of supplies will be necessary.

Storing dried specimens. As soon as plants are dry, they should be neatly stacked in piles, still in or on their pressing papers, a dry drier placed on the top and the bottom of the pile, and the whole tightly wrapped and tied in paper. In the temperate zone no further precaution is necessary. In the tropics, a small quantity of naphthalene flakes, distributed among the specimens, keeps out insects, while a wrapping of waterproof paper keeps out dampness and mold. If pressed by artificial heat, the plants should be wrapped immediately, while still hot and probably quite sterile of insects and spores. Wrapped bundles may be then stored for transportation in wooden boxes of appropriate size and weight.

The Herbarium

Identification of specimens. The individual botanist, who forms a private herbarium only, will probably find that his collections can be identified more easily before they have been mounted, when they can be turned over for examination on both sides and when parts can easily be removed for dissection. When large quantities of material are being handled, this advantage is more than offset by the danger of losing loose specimens or parts, of breakage, and of separation of specimens from their data.

Permanent labels. While names and accompanying data may be written on the papers only, a neatly printed label adds greatly to the appearance and general value of the collection. Such labels should be of good paper, not less than 2 by 4 inches and rarely if ever larger than 2½ by 5 inches, and should show clearly the name of the plant, the place and date where collected, the name of the collector, the serial number of the collection, if any is used, and any further useful information about the plant. Some parts of this may be printed, and when large collections are made from single localities, the printing of more details saves much writing by hand. Thus an amateur may have his labels headed simply Herbarium of John Smith, or at the top Plants of Kentucky and at the bottom Collected by John Smith. A more detailed label is shown in Fig. 3. Labels should in every

case be printed and all data except the name added before the specimen is mounted. If more than one specimen is collected of each species, to be used for exchange or sale, labels should be prepared for all of them at once and in exactly the same way. A serial number should also be given to each collection, so that *John Smith 331,* for example, will distinguish a single collection only and will serve to identify as parts of this one collection all plants bearing this number, no matter where they may eventually be deposited. This series of numbers should be continued and never repeated, even though John Smith collects no plants whatever through an interval of several years, or collects in widely

PLANTS OF PERU

Shrub 2 m. high; fls. white.

Dept. Loreto: Mishuyacu, near Iquitos, alt. 100 meters; forest

No. 162 G. KLUG, Collector October-November, 1929

FIGURE 3. A sample label.

different localities. When the labels have been prepared, one specimen with its label, or enough small specimens to make a good display, should be set aside for mounting; the others, similarly labeled, are duplicates, and may be used for exchange or sale.

Mounting. Safety of the fragile dried plants demands that they be attached firmly to a sheet of good quality paper in such a way that breakage and loss of parts may be prevented and the label may be properly displayed. It is also necessary to guard against insect depredations, since several species of small insects feed on dried plants and will ruin a herbarium in a short time.

Before mounting the plants, prepare a large shallow tray of enameled ware, or a metal tray thoroughly and completely lined with paraffin, and containing a solution of mercuric bichloride. The solution, which must not touch metal, is prepared by adding a tablespoonful of mercuric bichloride and an ounce of glycerine to two quarts of 95% alcohol. The specimen is dipped in the solution momentarily, the fingers being protected by rubber gloves,

then laid with the label between driers and dried under light pressure for 24 hours.

Some botanists do not believe in poisoning, fearing that the bichloride may in time damage the specimens. If they are not poisoned, insects must be excluded by other methods, as described below.

Mounting paper cut to the standard size, 16⅜ by 11½ inches, may be had from dealers in botanical supplies. Three methods are in vogue for attaching the specimens. (1) The glue is spread on a glass plate, the specimen laid on the glue, lifted as soon as all parts have come in contact with the glue, and transferred to the paper. (2) The specimen is inverted on the paper where it has been stored, painted with glue by a soft brush, and transferred to the mounting paper. (3) The specimen is laid on the mounting paper and affixed by a number of small strips of gummed linen, distributed in sufficient quantity over the stem, petioles, leaf-tips, flower-stalks, and other narrow parts. If the first two methods are used, it is well to supplement the glue by gummed strips over the stems. All loose parts should be placed in a small envelope, which is pasted on the sheet. Labels are attached in the lower right-hand corner by glue at each corner or strips of glue along both ends. After mounting, the specimens, alternating with driers, should be placed under light pressure until the glue is dry.

Arrangement. After the specimens have been poisoned, mounted on herbarium sheets, and properly labeled, the question of their arrangement comes up. The aim of arranging specimens is twofold: first, it is desirable to know where a certain plant has been placed in the collection so that it may be seen at any time, and second, the collection is arranged in a natural sequence so that it is a complete story of the flora of the region covered.

It is desirable to place several herbarium sheets together, so that, in using the herbarium, they may be considered at the same time. Thus all the specimens of a species, or of a genus, or, in the case of small herbaria, of a family, are brought together in one enclosing cover. The best covers for this use are made of Manila paper and are slightly larger than a single sheet—about 12 by 17 inches. In one of these 20 or 30 sheets can be placed; if more are acquired, the material can be divided into smaller taxonomic divi-

sions. Each cover must be labeled concerning its contents in one of the lower corners, where the data may be read without removing the cover from its position in the herbarium. Then the covers, each representing a more or less fine division of plants, are placed in a convenient sequence, such as may be found in any manual of taxonomy.

Storage. Finally comes the question of storage of the herbarium. The fact to be kept in mind is that every sheet must be readily available without disturbing other specimens. To this end an arrangement of upright cases is desirable. Such cases must be designed to keep the dust of the atmosphere from the specimens, and if they are insect-proof as well that is a good point. However, occasional fumigation by carbon bisulphide or original poisoning of the specimens will do away with the danger of insects. Several types of wooden and metal cases will be found convenient, but for a small herbarium a much simpler type of corrugated cardboard case is quite as useful. Such a case has been described in detail by Dr. E. D. Merrill (in Torreya **26**: 50–54. 1926).

Exchanges. It will be wished to increase the size and scope of a herbarium by other methods than by collecting. The amateur may best add to his collection by exchanging with botanists in other localities. The names of people similarly interested may be found by reference to botanical journals, or in such publications as the "Naturalists' Directory." An amateur can often effect exchanges with large institutions if his plants are collected in a little-known locality. In such institutions a small market for specimens may be found, although of course common plants, or plants from often-collected localities are not in demand.

Study of herbarium specimens. Most of our taxonomic knowledge is of necessity based on herbarium material and experience shows that most morphological features of the plant are exhibited just as clearly on the dried as on the fresh plants. Details of flower structure, however, are usually poorly exhibited and are revealed only by dissection.

In dissecting flowers, detached specimens from the packets pasted on the sheet or flowers removed from the specimen may be used. The flower is boiled in water for one to three minutes and then dissected under water. After boiling, the various parts re-

sume their original size and shape and frequently their natural position. It is well to save all dissected parts, and this may be done by drying and returning them to the envelopes, by preserving them in a small vial of alcohol, or by mounting them in glycerine jelly between slips of thin mica. In any case, the same material is then available for further examination in the future.

It is obvious that the accuracy of the name of a species, as shown on the label, may sometimes be called into question. It is highly advantageous that the person making the identification should add his initials or name, as well as the date, since it is clear that a Carex, for example, named by Bailey or Mackenzie will be of more value for future comparison than one named by an unknown person who may have had little familiarity with the genus.

H. A. GLEASON,
A. C. SMITH.

GROWING EXHIBITION FLOWERS[1]

In attempting to give you a few hints on growing exhibition flowers it will be necessary to assume that you are fairly good amateur gardeners, or at least, have some knowledge of the ordinary methods of cultivation; to start from the very beginning and lead up to exhibition standards would mean a very lengthy discussion, too much, in fact, for one afternoon. My remarks, therefore, will probably be of interest only to those who are growing flowers and have done, or intend doing, some exhibiting.

There are numerous articles available for the beginner on nearly all kinds of flowers and our horticultural periodicals contain many written by experts on their favorite specialties. The members of the horticultural profession, unlike most other professions, are willing and anxious to help the beginner or amateur and give them the benefit of their experiences at all times. Although I have been successful in winning many prizes, I do not claim to be a source of all information pertaining to exhibition standards; it would be impossible for me or anyone else to be able

[1] Abstract of lecture given by the Head Gardener of the Constable Estate, Mamaroneck, New York, in Conservatory Range 2, The New York Botanical Garden, on February 1, 1930.

to grasp all the essential details of superior cultivation displayed at our exhibitions.

To achieve success at exhibitions is in my opinion very largely a matter of paying strict attention to routine work. By this I mean such operations as cultivating, spraying, watering, staking, disbudding, and feeding, all done at the proper time. This is more important than most people imagine; in fact, it is the most important thing of all. Many people, and among them some gardeners have a delusion that successful exhibitors must be in possession of some secret knowledge in order to be able to grow such wonderful specimens. If we would rid our mind of such notions and get down to "brass tacks," as the popular expression has it, then we would soon approach perfection. There are no short cuts to winning a first prize meritoriously that I know of, but neither can there be any time lost in trying to cure disease, ridding plants of insect infestations, or building up weak ones.

Of course we must begin with the best possible stock, otherwise we start off with a big handicap. To know where to procure the best is quite an experience in itself, for no dealer in or raiser of plants, seeds or bulbs, no matter how high a reputation he may have, can supply the best of everything. Probably a flower show is the best place to take note of the finest strains and newest introductions, for no introducer of novelties can neglect an opportunity of this kind for displaying his products. Not all novelties, by any means, are improvements on existing varieties and we may spend considerable sums on new things and be not much better off, so we as exhibitors must diligently hunt for the worth-while by reading, observing, listening, and inquiring.

It is interesting to note that the hybridists and breeders of new plants are concentrating most of their efforts on quick-growing subjects such as Sweet Peas, Dahlias, Gladiolus, Roses, Delphiniums, etc., Iris and Orchids being conspicuous exceptions. The things that take years to bring to the flowering stage are meanwhile being somewhat neglected.

The matter of feeding and fertilizer is always an important one for the exhibitor and I am sorry to remark that many exhibitors overfeed their plants; this probably is the worst fault of all at exhibitions. There are many plant foods on the market today, probably a brand for each important flower and for some flowers

many brands. My experience in regard to this is that some fertilizers are more beneficial to a high standard of culture than others, even if they be of a lower analysis in plant food.

Plants seem to have an appetite for some kinds, others they soon tire of after responding favorably to the first applications. This probably depends on the compounding of the fertilizer, the filler used or the different materials used in making up the amount of plant food. There are enough good brands, both domestic and imported, guaranteed to give results that the amateur need take no chances, at least until he is qualified to experiment.

As a general rule, plants that are advancing to the flowering stage will be benefited by less nitrogen and an additional amount of phosphoric acid and potash, but straight chemicals should be sparingly used, for they are very powerful and it is often the amount of inert matter that a fertilizer contains that heads off disaster. We should avoid feeding during a period of very high temperature and also during a prolonged spell of wet cloudy weather.

Flowers generally can be improved just before the exhibition by applying a little shade. The natural function of flowering plants is to produce seed, flowers being only a means to an end, hence the exhibitor's job is to hold as many flowers as possible and keep them from going to seed, but this must not be overdone or weakened stems and poor color will be the result.

Many exhibitors fail in displaying their flowers in the freshest possible condition. Sometimes this is due to rough or careless handling, but mostly to a wilting condition, owing to a lack of moisture in the stem and foliage. Some stems are so hollow or so lack fibre tissue that it is impossible for them to absorb moisture quickly enough to keep them in a fresh condition when cut. The Poinsettia and Dahlia are two conspicuous examples. The best way with such stems is to seal them by burning immediately they are cut and depend upon such moisture as may penetrate the outer substance of the stem. The same treatment is applicable to stems that are of a wiry nature, such as Japanese Anemone, Thalictrum, Heuchera, etc. The Japanese, I believe, use this treatment to a great extent when cutting flowers, for they have a great love for the beauty of stems and never bury them in deep receptacles.

As a general rule, all flowers should be cut and immersed in water at least one night before being exhibited; twenty-four hours is better. Wilting is due to air penetrating the stem tissues and it is about as difficult for water to penetrate a stem containing a large amount of air as it is for steam or hot water to circulate in a radiator that is filled with air with no means of escape.

A wilted flower can sometimes be restored to a fresh condition by cutting the stem while in water, but to accomplish this the exhibitor must be able to determine how far the air has penetrated, and cut accordingly. Exhibitors usually wrap moss or cotton or something of an absorbent nature, soaked in water, round the end of stems and this helps to get the blooms to the exhibition in good condition.

Paradoxical as it may seem, I am inclined to think that not all flowers are improved by attaining the popular exhibition standard. Instead of glorifying flowers by extra care, as is our intention, coarseness is often the result. It would take an expert to recognize the lordly Mignonette, as shown today, with at least a foot of flower spike, and Gladiolus and Antirrhinums with three to four foot flower spikes could scarcely be termed improvements; Tulips and Narcissi that are forced to such proportions that they require supports are not efforts of refinement in my opinion.

Exhibitions are not new events with us any longer and they have never been more popular than at the present time. We have improved in many ways, in others we may have forgotten, or, perhaps it may be, that in a busier age we have become impatient with some of the finer things we used to exhibit that required several years' care to reach the exhibition stage.

I am inclined to think it took more skill to grow the slower-maturing subjects, for the chances of failure were many times greater than with those that come to maturity quickly. I have already remarked that many of our exhibits are overfed and display coarseness instead of perfection of form and color. We are still guilty of overcrowding, both with plants and cut flowers, especially in large groups and garden effects. We elevate plants that nature never meant to be elevated. We have a tendency to use conflicting characters in our eagerness to produce certain color effects, when as a matter of fact, harmony and contrast of form and character is a more important study than color. We incline

towards the spectacular rather than to emphasize simplicity, but with all our faults we are progressing and the proof of our progress is clearly demonstrated by the ever-increasing number of enthusiastic exhibitors which we have at most of our flower shows.

JAMES STUART.

NOTES, NEWS, AND COMMENT

Dr. and Mrs. N. L. Britton returned to New York on April 21, after an absence of five months in Porto Rico.

"Daffodil Day" was observed at The New York Botanical Garden on Tuesday, April 22, with most of the varieties, with the exception of the later "poeticus" types, in excellent condition.

Dr. B. O. Dodge, Plant Pathologist of the Garden staff, explained and demonstrated methods of growing the Monilia bread-moulds to a special meeting of the New York Association of Biology Teachers held at the Ethical Culture School at Fieldston on Saturday, April 12. He gave special attention to the sexual stages and hybridization and the resulting Mendelian ratios.

Dr. H. A. Gleason, Curator, left New York April 19, on a five months' leave of absence, to continue his studies of the higher plants of northern South America with special reference to making comparisons of recently collected specimens with material now preserved in European herbaria. He will also attend the meetings of the International Botanical Congress to be held in Cambridge, England, in August.

Dr. A. B. Stout, of the Garden staff, lectured on "Sterilities in Flowering Plants" on March 14, in a course of free public lectures given under the auspices of the University of Pennsylvania. On the following day he spoke on "Daylilies" before the Botanical Society of Pennsylvania in a series of lectures on "class studies on gardens," being given in the Macfarlane Hall of Botany, University of Pennsylvania.

In continuation of exchanges, the Garden Herbarium has recently received 1012 specimens of marine algae from the University of California. These specimens were collected chiefly by Dr. N. L. Gardner and Prof. W. A. Setchell, for the most part on the western shores of North America, though Japan, the islands of the South Pacific, and New Zealand are also represented. The shipment includes a number of species that are new to the collections of The New York Botanical Garden and a remarkable series of representatives of the rockweed and kelp families. Altogether it constitutes an addition of great scientific interest and value.

Among the collections of Oriental plants recently received for study by Dr. E. D. Merrill, Director-in-Chief, are one of more than 800 numbers made in Hainan, southeastern China, by representatives of the Lingnan University; one of about 1200 numbers made by Mr. Fang in Szechuan Province for the National Central University at Nanking; and one about 400 numbers made by Dr. A. W. Herre, in New Hebrides, New Guinea, Moluccas, Celebes, etc. Dr. Herre was a member of the Crane Expedition, sponsored by the Field Museum of Natural History of Chicago; the plants obtained by the expedition are to be divided among the Field Museum, Stanford University, and The New York Botanical Garden.

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H. A. GLEASON, PH. D. ..... *Curator*
FRED J. SEAVER, PH. D. ..... *Curator*
ARTHUR HOLLICK, PH. D. ..... *Paleobotanist*
BERNARD O. DODGE, PH. D. ..... *Plant Pathologist*
FORMAN T. MCLEAN, M. F., PH. D. ..... *Supervisor of Public Education*
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PERCY WILSON ..... *Associate Curator*
PALMYRE DE C. MITCHELL ..... *Associate Curator*
SARAH H. HARLOW, A. M. ..... *Librarian*
H. H. RUSBY, M. D. ..... *Honorary Curator of the Economic Collections*
ELIZABETH G. BRITTON ..... *Honorary Curator of Mosses*
MARY E. EATON ..... *Artist*
ROBERT S. WILLIAMS ..... *Administrative Assistant*
E. J. ALEXANDER ..... *Assistant Curator*
ALBERT C. SMITH, A. B. ..... *Assistant Curator*
CLYDE CHANDLER, A. M. ..... *Technical Assistant*
MARJORIE E. SWIFT, A. M. ..... *Assistant Pathologist*
ROSALIE WEIKERT ..... *Technical Assistant*
KENNETH R. BOYNTON, B. S. ..... *Head Gardener*
G. L. WITTROCK, A. M. ..... *Docent*
H. M. DENSLOW, A. M., D. D. ..... *Honorary Custodian of Local Herbarium*
ROBERT HAGELSTEIN ..... *Honorary Curator of Myxomycetes*
E. B. SOUTHWICK, PH. D. ..... *Custodian of Herbaceous Grounds*
ETHEL ANSON S. PECKHAM. *Honorary Curator, Iris and Narcissus Collections*
JOHN R. BRINLEY, C. E. ..... *Landscape Engineer*
WALTER S. GROESBECK ..... *Clerk and Accountant*
ARTHUR J. CORBETT ..... *Superintendent of Buildings and Grounds*

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IMPRESSIONS OF THE NEW YORK BOTANICAL GARDEN'S 1930 DISPLAY OF NARCISSI

The reactions of visitors to a collection such as that devoted to the Narcissi at The New York Botanical Garden are really very interesting to those in charge. Some people feel the plants are there for their own exclusive use and other visitors need not be considered. These few inconsiderate and selfish persons make depredations; they pick the largest flowers and they do it in a rough and careless way, generally throwing the flowers aside later and not even bothering to take them home with them. This is the type of person that tramples flowers and grass, that delights to leap through and over tall plants, that has no dignity or reserve. Fortunately they are few and far between and the general public seems to enjoy a place that is made beautiful for them; the more flowers there are, the less are destroyed. The idea, then, would be to have just as many flowers as possible in public parks and that part of The New York Botanical Garden which is planted with Narcissi is certainly extremely floriferous at the blooming season. A few of the visitors make as their excuse for picking flowers, that they "thought the plants were wild" but this type always is delighted to obey the rule not to pick and just to look, once the matter is properly explained to them and they understand the reason for it.

One old lady who saw the Daffodils for the first time remarked that she did not care for the large masses of one variety, saying there was "too much yellow;" she preferred a planting where the varieties were in smaller quantities, so the effect was more mixed; "so," she said, "if you have many varieties, people will know at once." This idea is directly contrary to an effect such

FIGURE 1. A part of the Narcissus plantation at The New York Botanical Garden, May 1, 1930.

as one would really have where the plants are in a wild state. Then the varieties would be regulated by the kind of soil, the exposure, the drainage or lack of it and, above all, by the climate, and one would rarely see large masses of more than two varieties of Narcissus together. Usually it would be but one variety.

After studying the collection at The New York Botanical Garden for several years, the theory that Trumpet Daffodils do

FIGURE 2. Narcissi at The New York Botanical Garden, April 25, 1930.

not "naturalize" satisfactorily is vindicated. They assuredly are affected by abnormal seasons and all of them with the exception of Sulphur Beauty, Fairy, and Emperor, showed a tendency towards poor bloom this spring. If this summer should prove a normal one, it will be of interest next spring to note whether the Trumpet varieties bloom better or whether they still continue their scant display. King Alfred has deteriorated to such a degree that some other sort, preferably an Incomparabilis variety, should replace it and the old and ugly double Von Sion, which (luckily) is rapidly disappearing, can be replaced by a Poeticus sort that

might be planted so as to grow up among the bushes at the base of the rocks. *N. poeticus ornatus* used in this way behind the Trumpet Daffodils near these same rocks has been very successful, which shows that Poeticus varieties need little depth of soil to thrive. This is probably true of Narcissi with Leedsii "blood" in them, such as White Lady, for the planting above the rocks, where the soil is really very shallow, has grown beautifully and gives a magnificent display each year. Giant Leedsii seem to be just as satisfactory as those of the other section of the Leedsii group. They bloom notwithstanding rainy summers, when bulbs need sun to ripen them well; in spite of severe and changeable winter weather; despite autumn drought, when bulbs need rain to produce the many roots necessary for good flowering. They continue to put up fine flowers when growing under crowded conditions that would soon cause Trumpet varieties to flinch. The variety White Queen has flourished in the grass and this year was particularly fine. This is no new sort but is still a reliable one, as is also St. Vincent. Phyllida was noted this year as being a handsome sort belonging to this group.

Of small Daffodils, the most outstanding, perhaps, has been Elizabeth Ryan, which is of good quality, with flat, even perianth of a clear white, the segments overlapping nicely, and the small pale-yellow cup showing a neat even shape. This flower is most suitable for a rock-garden but, because of its short stature, care should be exercised when placing it in the garden-border that it is well towards the front of any group. A good combination might be made with Sirdar, a Giant Leedsii, and Bernardino, an Incomparabilis, at the back. Giraffe, a yellow Incomparabilis, and Weardale Perfection, a bi-color Trumpet of delicate tints, might come next, while in the foreground would be Elizabeth Ryan and a beautiful white hybrid with two flowers on a stem, Undine. And so it goes; each year a collection of this sort proves of value for study purposes and each year widens the uses to which these studies and the collection itself can be put.

ETHEL ANSON S. PECKHAM.

SOME EXAMPLES OF INTERRELATIONS OF ROCKS AND TREES

Rock outcrops and the trees that grow upon them frequently present not only picturesque bits of scenery but also examples of interrelations that are both interesting and instructive; and the outcrops of Manhattan schist within the forested area of The New York Botanical Garden provide numerous examples of such interrelations.

The schists are extensively folded, and the eroded surfaces of the anticlines are unevenly worn and weathered, according to the relative hardness or softness of the strata where they are exposed; and the uneven surfaces are suggestive of a miniature series of irregular subparallel ridges and valleys. The latter represent lines of weakness in the rock structure in the direction of the bedding planes, and fracturing or splitting often occurs along these lines. The strata are also paralleled and criss-crossed by joints—often including both a minor and a major system that traverse the rock throughout and divide it into more or less irregular rectangular or rhomboidal blocks or sections, of various dimensions. Faults and slips or shear planes may also be seen in certain of the outcrops. These surficial inequalities and fractures of various kinds represent loci for ingress of moisture, accumulation of soil, growth of vegetation, etc., and for the gradual disintegration of the rock.

When conditions are such that the germination of the seeds of trees is possible in one of these loci, and trees gain a foothold there, their root systems, constantly extending and expanding wherever and whenever opportunity offers, assist rain, frost, and other natural agencies in enlarging the inequality or expanding the fracture and in hastening the rock disintegration.

Many seedlings outgrow the possibilities of existence in their cramped environment and perish early in life; others manage to maintain themselves in stunted form for a greater or less length of time; some are so located that they are able to develop coincidently with the disintegration of the rock and grow to maturity. The position and location of an irregularity or crack or crevice of any kind in which a tree has germinated is of primary importance in connection with their subsequent interrelations. An ap-

FIGURE 3. Young black-birch seedlings rooted in a horizontal rock joint in the face of a ridge. Photograph by H. C. Hartmann.

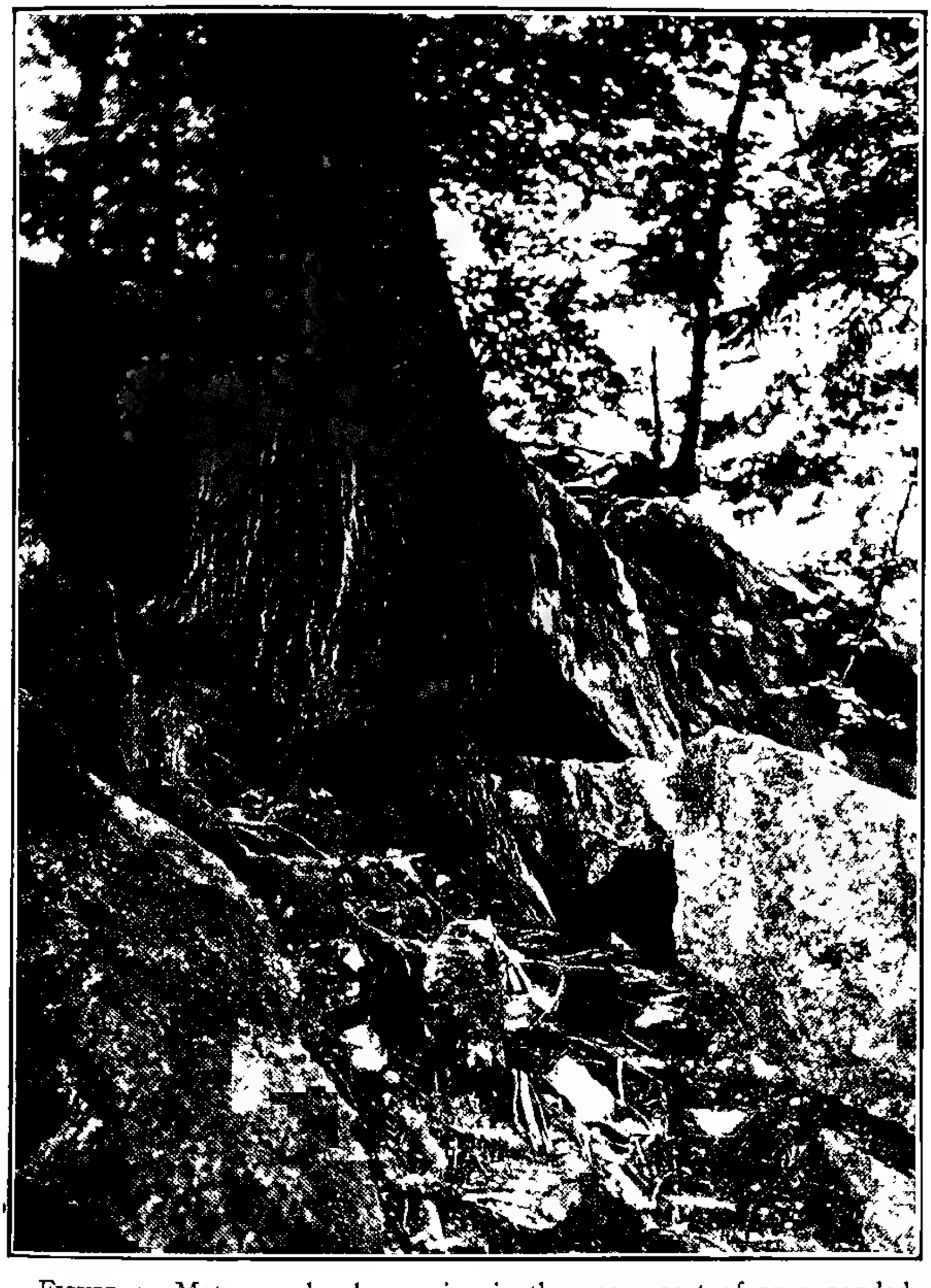

FIGURE 4. Mature red oak growing in the upper part of an expanded, vertical fracture in the side of a cliff. Photograph by H. C. Hartmann.

proximately vertical crack or crevice is in a more favorable position for enlargement than is one that is more or less horizontal. Moisture gains access more readily, roots are encouraged to extend downward—their natural direction; and, if any such crack or crevice is parallel with and relatively near to the face of a ridge or cliff, expansion, and consequent fracturing and splitting of the rock, is facilitated.

In FIGURE 3 may be seen two black birch (*Betula lenta* L.) seedlings that are rooted in a horizontal joint in the steep face of a ridge. They are manifestly poorly located for future development. Any expansion of the joint must be accomplished in opposition to the force of gravity and the weight of the superincumbent rock. The indications are that rock disintegration is proceeding, and will continue to proceed, more rapidly in connection with the vertical joint to the left than with its neighbor to the right, and also that the sharp downward bend of the horizontal joint toward the left favors root growth in that direction.

FIGURE 4 represents a vigorous red oak (*Quercus rubra* L.), possibly 40 or 50 years old, which evidently began its life in the upper part of a vertical fracture in the side of a cliff. The main root system of the tree may be seen extending downward, following the expanded fracture with its accompanying disintegrated rock and soil. Above, to the left, may be seen the continuation of the fracture over the top of the cliff—well defined but relatively narrow. The steady growth of the tree has been an important factor in accelerating the widening of the crevice and the fracturing and disintegration of the surrounding rock, and it may be expected to do so as long as the base of the tree and its roots continue to develop and expand.

FIGURE 5 is a view of the northern end of a prominent rock outcrop in the Hemlock Grove, showing hemlocks [*Tsuga canadensis* (L.) Carr.] in various stages of growth, some of which are rooted entirely or in part in the soil of the forest floor at the base of the outcrop and others in the rock fractures. Toward the left is a tree that has its main roots extending down into the soil, and minor roots that have secured footholds in the horizontal joints of the rock. It apparently started its life in the soil, which was subsequently washed away, and incidentally extended certain of

FIGURE 6. Close view of one of the trees included in FIGURE 5, showing the exposed root system extending in part into the soil of the forest floor and in part into the rock joints. Photograph by H. C. Hartmann.

FIGURE 7. Black birch with exposed root system straddling a bare rock surface for a distance of about 35 feet. Photograph by H. C. Hartmann.

its roots into the conveniently located joint. A relatively small tree may be seen toward the right center, which has its entire root system in the rock—partly in a vertical joint that is parallel with the planes of stratification and partly in a horizontal joint. At the extreme left may be seen a dismembered section of the exposed outer edge and side of the outcrop, which has broken away along the line of one of the vertical joints coincident with one of the bedding planes; and the section immediately adjoining is already partly separated from the parent mass by a prominent joint parallel with the other one.

FIGURE 6 is a close view of the lower part of the above-mentioned tree, shown toward the left in FIGURE 5, rooted in part in the soil of the forest floor and in part in the rock joints. A vertical joint, conspicuously widened and fractured in its upper part, is shown to the right of the tree trunk. The joint is parallel with the original bedding plane of the rock, and the lines of stratification may be seen, well defined, on the surface of the rock outcrop, running parallel with the joint.

FIGURE 7 represents a black birch (*Betula lenta* L.), the two main roots of which are straddling the surface of the bare rock for a distance of about 35 feet. The trunk is about 3 feet in circumference. The root on the left, from the base of the trunk to where it disappears in the soil, measures 20 feet in length, and the one to the right 15 feet. It is obvious that the tree could not have started its life as a seedling under the conditions that now obtain, and the probable explanation is that at the time when the seedling tree germinated the rock surface was covered with soil which subsequently was gradually washed away and receded further and further down the steep sides of the outcrop, and that the root ends continued to follow the receding soil, leaving the base of the trunk and the upper parts of the roots completely exposed.

Numerous other equally striking or more conspicuous examples of similar features may be seen within the Garden area, and it would be interesting to photograph certain of these from time to time in the future, in order that illustrated records of the changes wrought by natural agencies may be available.

ARTHUR HOLLICK.

THE ORIGIN OF CIVILIZATION IN RELATION TO THE ORIGIN OF CULTIVATED PLANTS*

Man has done little to vary his food supply or his kinds of domestic animals since the dawn of recorded history. All of the important cultivated plant foods and all the domestic animals were already tamed long before the first written records were made. Of course all of these were derived originally from wild forms of the regions in which civilization developed. While we take great pride in the rapid advances of science and of mechanical contrivances in modern times, the accomplishments of modern man in improving plants and animals are really insignificant as compared to those of our prehistoric ancestors who first tamed and brought into his service these plants and animals. In fact, man's capacity for adapting new living things to his use appears to have developed early in his evolution. For all of the important basic food plants have their native homes in comparatively small areas and in each case these natural habitats are the places where ancient civilizations took their rise. Elsewhere on the globe, rich stores of useful plants seem to have been sorely neglected. Thus no important basic food plants arose from all of North America north of Mexico, all of Australia, and all of South Africa. The highlands of Mexico and of Peru, Asia Minor, and the Mediterranean Regions, India and China, are those areas in which civilizations developed and from these same rather limited areas our most important or basic food plants and domestic animals came. In many cases these domesticated forms have not taken kindly to the new regions into which man has migrated and their care and maintenance under inhospitable conditions has often-times proven a great burden on civilized peoples. But we still demand our wheat and mutton, oatmeal and eggs, and as insistently as if these were the natural products of the New World in which we live.

E. D. Merrill

*Abstract of a lecture given at The New York Botanical Garden, on Saturday afternoon, April 19, 1930.

THE TEN COMMANDMENTS OF ROSE-GROWING*

1. Rose culture is simple. Too many books have tried to make it hard.

2. Any soil that will grow a good crop of weeds is good for roses. There is no soil so poor that it cannot be amended. Humus is necessary to soil fertility. No matter how the soil analyzes, or how abundant the chemicals that are required to make the soil fertile, if you haven't humus, it is dead. Addition of manure adds humus to the soil. There is very little left in the manure we get now-a-days, except humus.

3. Start with the right plants. Do not buy plants because they are cheap. The roses are like anything else; the cheapest is the most expensive in the end. Budded plants are recommended in preference to ones on their own roots. Many varieties grow stronger and flower better, if budded on strong Manetti roots. All do well budded, therefore why should I limit my selection to varieties which do well on their own roots when I can have a very large selection of budded plants? Another reason why I want budded plants is they are mature. The root of this plant (showing a budded plant) was started in the spring 1927 from seed, during the summer of 1928 it was budded and in the season of 1929 it grew. The only own-rooted plants available in the market are little slips that have never seen out-door conditions and it is up to you to bring them to maturity by care.

4. Prune severely.

5. Keep the hoe active. If you take people at random and ask them why the soil is to be cultivated, or ask a farmer, they will tell you, to keep the weeds out of the garden. Of course, but the real reason is that hoeing helps oxygen and moisture to reach the roots. Roots breathe in the soil as fish breathe in the water.

6. Feed or stimulate cautiously if at all. Plants die from indigestion. It is murder to fertilize or give stimulation the first year. When feeding them the first season you are poisoning them. Do not overdo summer feeding. Even with old plants do not overdo it. When you plant roses next spring, leave them alone. Do not use fertilizer or any kind the first year.

*Abstract of a lecture given at The New York Botanical Garden on November 2, 1929.

7. Fight enemies. All plants have some enemies and the roses have no more. There are roses that have hardly any enemies and the others have no more than other plants. We can plant varieties of all colors which do not have black spot. When they have been infected with aphis, just give them a little soap and "black leaf forty" (nicotine). If you haven't "black leaf forty," use the soap suds.

8. For a long time black spot was considered a leaf disease only and it was thought that after the leaves dropped they did not have the disease any longer. But by study we have found that black-spot spores are carried over winter on the wood, so therefore clean your plants for the winter. Keep on spraying until your plants are thoroughly clean before applying winter protection. The best medium is lime sulphur when the foliage is off your plant. Clean the plant thoroughly with lime sulphur and kill the germs that may be resting on the top of the ground. Repeat the operation two or three times during the winter on the part of the plant that is exposed and you will see how your plant will benefit. Sanitation is the most important part of the resistance of plants. Cold winds will do harm, but much we have been blaming on cold we have found is due to diseased condition.

9. Fertilize the soil in the late autumn for the following year. The plants like to have their food well prepared and assimilable. The best fertilizer we have found yet for roses, and I believe for anything else, is bone meal. There is no danger to your plant with bone meal. It requires about six months to be thoroughly digested for the plants, so if you want your plants to receive the benefit of fertilizers now (November) is the time to apply the bone meal, a handful to a plant, scattered and well worked in.

10. Apply simple winter protection. There is a way of protecting your plants reasonably and cheaply. Hill up your plants eight or nine inches by bringing the soil up along your plants. If you want to get the best of your plants, use good clean earth. If you want to use manure, put it in the hollow, which will do no harm. Scatter straw on top in January, not as a blanket, simply to break the wind. Do not believe that when plants are called dormant that there is no process of life, because that life is in the tissues. When the ground is frozen and the top of the plants

exposed, 20 degrees above zero with wind is far more deadly to vegetation because of drying, than a much colder temperature with the plants protected. Straw that you scatter over your plants breaks the winds and reduces evaporation. A very good method of winter protection in the far north is to wrap the plants in tar paper.

A most important operation is the pruning of roses, trees, and shrubs. If you prune roses, you disturb the comfortable order of their lives. They do not want to work more than they have to. By pruning your plant the roots are placed in a position of discomfort. It has to grow to replace what it has lost. The plant would die of starvation if it did not. Each one of the eyes left on the plant is going to grow a stem twelve or thirteen inches, then a perfect bloom. The pruning is increasing the pressure from the root system. There have been all kinds of advice given on pruning. The simplest way is to remove two thirds of the previous year's growth. That takes care of the size of the plant, according to the vigor of the variety. If your plants have been properly pruned you will find three or four shoots. Remove the old wood. Whether your plant is small or large, two thirds should be cut off. If the plant is cut two thirds it will give you roses, perfect, with long stems and serviceable. It will soon sprout two or three stems off each branch. The time to prune is about the middle of April. Start first with hardy plants. You may have an early season or a late one. As soon as you begin to prune your plants they start growing, so don't prune them too early. If you see a few leaves coming on the top of your roses never mind them. A great many plants have failed to grow on account of lack of pruning. In a newly planted rose garden you should hardly be able to see that there is anything in the garden; that is, you should hardly see that anything has been planted. The following summer you would have plants at least two feet high which would keep on blooming. Transplanting is a major operation and the plant will take a long time fully to recover. It takes a tree five years, and roses one year fully to recover. You never see old plants dying in summer. It is the new plants that die. To have your roses successful you must prune.

J. H. Nicolas.

ORNAMENTAL PLANTING FOR SMALL GROUNDS*

Small homes benefit even more than large estates by proper planting. Great interest is shown on the part of the present generation in the selection of a good design suited to the limited area. But often this work is carried out by someone wanting to sell plants and all types and varieties of plants are crowded into a small space.

There is an economic value in making a plan and selecting a few good plants to carry out the scheme. There is great danger in adding too many features to limited space and also danger in misplaced pools. Careful study of scale is necessary as well as of conditions in which the plan is to be carried out. Consideration of the type of soil, amount of sunshine, and the water supply all comes into the culture of the plants, but the first thing to do is to get clearly in mind a definite plan and carry it out in a practical way. There can never be "rubber-stamped" designs, for each situation has its many problems to consider.

People are often over-awed by the fear of expense regarding the plan while they squander money on evergreens and other plants and then feel that the picture they tried to make is a failure. Then they ask the landscape architects to correct a bad thing. This is always expensive, because much of the material used is often discarded. Make a study of the area. Read "The Design of Small Properties" by Bottomley, draw up your own plans if you feel capable, but get some trained person to check them for you. With small properties, make sure you are right in design and then go ahead after preparing the soil and select suitable plants for the area.

Landscape architecture is a profound art—not only considering the beauty of the grounds but the utility also. Size of human beings does not differ much, neither does the size of the things they use, but the arrangement and the scale of things used both in the house and in the garden are sometimes not given sufficient study.

Have a bit of lawn where possible. Do not invest in plants that will not thrive in your soil. Do not spot your property with

*Abstract of a lecture given at The New York Botanical Garden, on Saturday afternoon, March 1, 1930.

a collection of nursery stock. Do not start planting without a plan, for you will frequently end up by calling the scheme a failure and forever apologizing to friends about. Do not try to copy a large estate scheme on a small area. But by all means, plant trees, shrubs, and flowers according to a worked-out plan, and not by chance.

HUGH FINDLAY.

NOTES ON SOME PLEISTOCENE MOSSES RECENTLY DISCOVERED

In making excavations for a large building in Minneapolis, Minn., recently, fragments of various mosses were found mixed in with numerous molluscs and higher plants that had been washed down and deposited with silt and sand in layers up to 18 inches in thickness, according to Professor William S. Cooper of the University of Minnesota, by whom they were sent for determination. These deposits seem to be late Pleistocene, formed perhaps thirty thousand years or more ago, I believe, and contained three species of moss, one evidently the same as a well-known bog moss of today, the other two apparently unknown before. The specimens, all brown or blackish and mostly pretty well broken up, showed at least in a few cases almost perfect outlines of leaves and leaf-cells, descriptions of which will appear later.

The above find is very similar to one made in Washington, D. C., last year in excavating for an addition to the Government Printing Office. These Washington specimens, received from Prof. E. W. Berry last fall, were in much smaller quantities, more blackish and broken up than the Minneapolis specimens but there seemed to be at least five species represented, all of which are common in the same general region today. At least a few leaves of all the Washington specimens were found in quite perfect condition, showing well the cell structure, so as to be determined without much doubt. A more detailed account of the species will be published by Professor Berry.

R. S. WILLIAMS.

CONFERENCE NOTES FOR MARCH AND APRIL

At a conference of the Scientific Staff and Registered Students held on March 12th, Mr. A. C. Smith reported on "A Collecting Trip across Peru," using lantern slides for illustration. This report was published in detail in the JOURNAL OF THE NEW YORK BOTANICAL GARDEN for April, 1930.

At the conference in April the following program was presented:—

"A Short Phytogeography of the Prairie and Plains Region" by Dr. P. A. Rydberg.

"Notes on some Specimens of Pleistocene and Post-Pleistocene Mosses" by Mr. R. S. Williams.

The paper by Dr. Rydberg will be published in the future. A summary of the report by Mr. Williams is published in this issue of the JOURNAL OF THE NEW YORK BOTANICAL GARDEN.

A. B. STOUT,
Secretary of the Conference.

PUBLIC LECTURES DURING JUNE, JULY, AND AUGUST

Delivered in the Lecture Hall of the Museum Building on Saturday afternoons at 4:00 P M.; illustrated by lantern slides and otherwise; free to the public. Doors closed at 4:00; latecomers admitted at 4:15; lectures close promptly at 5:00.

June 7. "Daylilies,"
Dr. A. B. Stout, Director of Laboratories.

June 14. "Over the Andes and down the Amazon,"
Mr. Albert C. Smith, Assistant Curator.

June 21. "Trees and Shrubs of Greater New York,"
Dr. A. H. Graves, Curator of Public Instruction, Brooklyn Botanic Garden.

June 28. "Roses," Mr. Kenneth R. Boynton, Head Gardener.

July 5. "The Philippine Islands,"
Dr. Elmer D. Merrill, Director-in-Chief.

July 12. "Porto Rico: Its Flora and Scenery,"
Dr. Marshall A. Howe, Assistant Director.

July 19. "Plant Traps,"
Dr. John Hendley Barnhart, Bibliographer.

July 26. "Diseases and Pests of Ornamentals,"
Dr. B. O. Dodge, Plant Pathologist.

August 2. "Fungi, Edible, Poisonous, and Otherwise Interesting."
Dr. Fred J. Seaver, Curator.

August 9. "Florida,"
Dr. John K. Small, Head Curator of the Museums.

August 16. "Fossil Plants of New York City and Vicinity,"
Dr. Arthur Hollick, Paleobotanist.

August 23. "Wild Flowers of Late Summer,"
Dr. Forman T. McLean, Supervisor of Public Education.

August 30. "Growing Plants in Artificial Climate,"
Dr. J. M. Arthur, Boyce Thompson Institute.

How to Reach the Museum Building

The Museum Building is reached by the Harlem Division of the New York Central Railroad to Botanical Garden Station, by trolley cars to Bedford Park, or by the Third Avenue Elevated Railway to Botanical Garden, Bronx Park. Visitors coming by the subway change to the Elevated Railway at 149th Street and Third Avenue. Those coming by the New York, Westchester, and Boston Railway change at 180th Street for cross-town trolley, transferring north at Third Avenue.

NOTES, NEWS, AND COMMENT

Among recent visitors to the Botanical Garden who are interested in tropical plants in a commercial way has been Mr. A. Rodriguez Montes de Oca, formerly of Mexico, now of New York. Mr. Rodriguez is interested in fibers, such as the "kapok" from the silk-cotton tree and also in the fish poisons produced by species of *Cracca* (*Tephrosia*).

Mr. Carlos E. Chardon, Commissioner of Agriculture and Labor of Porto Rico and Mr. Rafael A. Toro, Plant Pathologist of the Department of Horticulture of Colombia, spent some time at the Garden during the months of May and June, working over their collections of South American fungi, preparatory to the publication of a check list of the fungi of Colombia.

Mr. Robert Hagelstein of Mineola, Long Island, has recently been appointed Honorary Curator of Myxomycetes of The New York Botanical Garden. Mr. Hagelstein has devoted much

time to the study of the diatoms and Myxomycetes and has one of the largest private collections of the latter to be found in the East. He will spend some time at the Museum Building, arranging and studying the Garden collection of slime-moulds [Myxomycetes].

Meteorology for April: The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 63° on the 5th; 62° on the 10th and the 11th; *80° on the 14th;* and 75° on the 27th.

The minimum temperatures recorded were: 29° on the 3rd and the 10th; 37° on the 17th; *28° on the 24th;* and 37° on the 29th.

The total precipitation for the month was 2.30 inches. Traces of snow were recorded on the 8th.

ACCESSIONS

LIBRARY ACCESSIONS DURING OCTOBER, 1929 (CONTINUED)

SIMMONS, JAMES RAYMOND. *The historic trees of Massachusetts.* Boston, 1919.

SIRODOT, SIMON. *Étude anatomique, organogénique et physiologique sur les algues d' eau douce de la famille des Lémaneacées.* Paris, 1872.

Sitzungsberichte der Königl. böhmischen Gesellschaft der Wissenschaften. Mathematisch-naturwissenschaftliche Classe. Jahrgang 1888, 1899, 1900. Prag, 1889–1901.

SLOBODA, DANIEL. *Rostlinnictvi.* V. Praze, 1852. (By exchange with Dr. Karel Domin.)

SMITH, EDWARD. *The life of Sir Joseph Banks, president of the Royal society, with same notices of his friends and contemporaries.* London, 1911.

SMITT, JOHAN WILHELM. *Skandinaviens förnämsta ätliga ach giftiga svampar.* Ed. 2. Stockholm, 1867.

SMYTHIES, EVELYN ARTHUR. *India's forest wealth* Ed. 2. London, 1925.

SOMERVILLE, WILLIAM. *How a tree grows.* London, 1927.

SPEEDE, G. T. FREDERIC S. BARLOW. *The new Indian gardener and guide to the successful culture of the kitchen and fruit garden in India.* Calcutta, 1848.

STERNER, KARL RIKARD. *Ölands Växtvärld.* Kalmar, 1926.

STRASBURGER, EDUARD ADOLF. *Streifzüge an der Riviera.* Ed. 3. Jena, 1913.

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ACCESSIONS

MUSEUMS AND HERBARIUM

100 specimens "American Grasses" Century 10. (By exchange with the United States Department of Agriculture.)

45 specimens of cacti from Arizona. (Given by Mrs. Charles W. McKelvey.)

1 specimen of *Crotalaria incana* from Florida. (Given by Mr. W. M. Buswell.)

100 specimens of flowering plants from Hampden County, Massachusetts. (Distributed by Mr. Frank C. Seymour.)

10 specimens of African trees. (Given by the Imperial Forestry Institute, through Professor J. Burtt-Davy.)

1 specimen of the fruit of *Caesalpinia Recordii* from British Honduras. (Given by Professor Samuel J. Record.)

24 specimens of flowering plants from Cuba. (By exchange with the Arnold Arboretum.)

6 specimens of flowering plants from New Providence, Bahamas. (Given by Mr. L. J. K. Brace.)

17 specimens of flowering plants from Cuba. (By exchange with Brother León.)

16 specimens of flowering plants from North America. (Given by the United States Department of Agriculture.)

4 photographs of specimens of *Alchemilla*. (Given by the Herbarium of Harvard University.)

1 specimen of *Galeorchis spectabilis* from Ohio. (Given by Dr. H. M. Denslow.)

3 specimens of *Zollernia Tango* from Honduras. (By exchange with the Field Museum of Natural History.)

2 specimens of *Cyperus difformis* from California. (Given by Dr. Elmer D. Merrill.)

16 specimens of flowering plants from North America. (Given by Dr. H. M. Denslow.)

56 specimens of flowering plants from tropical America. (By exchange with the Field Museum of Natural History.)

6 specimens of flowering plants from North America. (Given by Dr. Sidney F. Blake.)

1 specimen of *Alisma Plantago* var. from Utah. (Given by Dr. P. A Rydberg.)

1 specimen of *Mitrocarpus breviflorus* from Texas. (By exchange with the United States National Museum.)

12 specimens of flowering plants from Cuba. (By exchange with Brother León.)

557 specimens of miscellaneous flowering plants. (By exchange with the University of California.)

1 specimen of *Blechum* from Fort Myers, Florida. (Given by Mr. W. Buswell.)

1 specimen of *Echinacea purpurea* from Virginia. (Given by Dr. W A. Murrill.)

300 specimens of flowering plants from California, Oregon, and Washington. (Distributed by Mr. A. A. Heller.)

6 specimens of Cassia from tropical America. (By exchange with the Field Museum of Natural History.)

1 specimen of *Baptisia perfoliata* from Florida. (Given by Mr. Severin Rapp.)

355 specimens of North American plants from the Marcus E. Jones Herbarium. (By exchange with Pomona College.)

1 photograph of *Sphaeralcea Emoryi*. (Given by Mr. Thomas A. Kearney, Jr.)

4 specimens of flowering plants from British Honduras. (Given by Mr. C. L. Lundell.)

6 specimens of ferns and flowering plants from tropical America. (By exchange with the United States National Museum.)

145 specimens of flowering plants from North America. (By exchange with the Field Museum of Natural History.)

19 specimens of ferns and flowering plants from Hawaii. (By exchange with Mr. Otto Degener.)

24 specimens of flowering plants from Cuba. (By exchange with Harvard University.)

34 specimens of flowering plants from Missouri. (Given by Mr. B. F. Bush.)

36 specimens of flowering plants from Alaska. (Given by the American Museum of Natural History.)

1 specimen of *Cyperus Pringlei* from the Tonto National Forest. (Given by the Forest Service.)

1 specimen of *Atragene americana* from Rockland County, New York. (Given by Mr. Harold K. Whitford.)

2 specimens of *Thlaspi perfoliatum* from Pennsylvania. (Given by Mr. H. A. Ward.)

160 specimens of flowering plants from Venezuela. (Distributed by Mr. Henri Pittier.)

50 specimens of fungi from North America. (By exchange with the University of California.)

9 photographs of herbarium specimens. (By exchange with Harvard University.)

171 specimens of mosses, ferns, and flowering plants from Venezuela. (Distributed by Mr. Henri Pittier.)

559 specimens of flowering plants from the Old World. (By exchange with the Royal Botanic Gardens, Kew.)

194 specimens of flowering plants from tropical America. (By exchange with the Carnegie Museum, Pittsburgh.)

41 specimens of Onagraceae. (By exchange with Pomona College.)

25 specimens of flowering plants from Maine, Quebec, and Newfoundland. (By exchange with Harvard University.)

162 specimens of algae, fungi, bryophytes, and flowering plants from Uruguay. (Distributed by Dr. W. G. Herter.)

6 specimens of flowering plants from Alberta. (By exchange with Mr. Rollo H. Dixon.)

49 specimens of flowering plants from British Columbia and Alberta. (By exchange with Mr. N. B. Sanson.)

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JOURNAL
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N. L. BRITTON

COFFEE
H. H. RUSBY

PLANT LIFE SOUTH OF THE ICE FRONT DURING THE GLACIAL EPOCH
ARTHUR HOLLICK

THE TREES AND SHRUBS OF GREATER NEW YORK
ARTHUR HARMOUNT GRAVES

NOTES, NEWS, AND COMMENT

ACCESSIONS

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SCIENTIFIC SURVEY OF PORTO RICO AND THE VIRGIN ISLANDS

As Chairman of the Committee of The New York Academy of Sciences on the Scientific Survey of Porto Rico and the Virgin Islands, the insular possessions of the United States in the American tropics, I was in Porto Rico for five months from November, 1929, to April, 1930, accompanied by Mrs. Britton, who gave me continued assistance, and whose facility in the Spanish language paved the way for many interesting observations and discoveries and for many enjoyable occasions, not otherwise obtainable, because, even after thirty years of United States control, with an enormous development of the educational system, the language and literature of Porto Rico remain essentially Spanish, which is just as good as English, if you happen to know it. Our studies were facilitated by His Excellency, Governor Roosevelt, and Mrs. Roosevelt, by Hon. Carlos E. Chardon, Commissioner of Agriculture and Labor, and Señora Chardon, and by Hon. Jaime Bagué, Assistant Commissioner, and Señora Bagué.

The investigations, conducted by the Committee, since 1914, including Geology, Palaeontology, Botany, Horticulture, Forestry, Zoology, Archaeology, and Anthropology, have been in coöperation with the Insular Government of Porto Rico, the American Museum of Natural History, the Department of Geology of Columbia University, The New York Botanical Garden, and with aid by members of the scientific staffs of many other institutions and other students, either in field work, or in the study of the very large collections of specimens which have been made, or in both; the results are in progress of publication, in a series planned to

consist of sixteen volumes, each of four parts; about one-half of this series, thirty parts, have now been issued, four more are in press for publication during 1930, and the remainder of the work is in preparation. Altogether, over fifty investigators have taken part, or are still occupied; the work has been, essentially, a labor of love, no one participating having received any special financial remuneration; specimens have enriched the museums of coöperating institutions and authors receive the credit for their contributions through publication. It has been most gratifying to demonstrate that the scientific knowledge required for the consummation of the plan exists within our institutions or among individual students not attached to institutions.

For purposes of the Geology of the Survey, Porto Rico was areally divided into seven districts, with the Virgin Islands and the Porto Rican islands Vieques (Crab Island) and Culebra (Snake Island) constituting another. Results of the study of five of the Porto Rico mainland districts, with maps and illustrations, have already been published, as well as parts of those of the study of the small islands. The remaining geological parts are being written by Professor Howard A. Meyerhoff, of Smith College, who, with Mrs. Meyerhoff, made the field studies a few years ago. During our recent visit we obtained some additional fossils from limestones of his districts for consideration by him. We observed, with interest, a new establishment for the fabrication of roof-tile and hollow brick, directly from a decomposed rock, identified for us by Professor Berkey as andesite porphyry, located near La Muda, near the western border of the Fajardo District. We revisited the manganese mine in the marble mountain, Sierra de Naranja, near Juana Diaz, and learned of another recently discovered manganese deposit near Adjuntas. Several of our geological trips were under the guidance of Don David Noble and Don Ramón Gandía, engineers and geologists.

Botanical and horticultural studies were largely devoted to observations on the very many economic and ornamental plants in recent years experimentally introduced into Porto Rico from many parts of the world and their behavior under the climatic and soil conditions. These studies were facilitated at the United States Agricultural Experiment Station, Mayagüez, by Mr. D. W.

May, Director, and Mr. T. B. McClelland, Senior Horticulturist; at the Forest Station, Rio Piedras, by Mr. William P. Kramer, Chief Forester, and his assistants, Messrs. C. Z. Bates, G. E. Gerhart, and W. C. Hottle; at the Insular Agricultural Experiment Station, Rio Piedras, by Mr. R. Fernandez García, Director; Dr. Mel T. Cook; Don Pedro Osuna; Don Francisco Sein, and Mr. J. A. B. Nolla; at the Trujillo Plant Propagation Station, by Señor Adolfo Mayoral; we are also indebted for aid and information, horticultural and botanical, to Don Andrés Oliver, of Arecibo, and Señora Oliver; to Don Lorenzo Oliver and Señora Oliver, also of Arecibo; to Mr. Robert B. Noyes, of Ponce, and Mrs. Noyes; to the Misses Noble, of Condado; to Mrs. F. T. Maxwell, of Ensenada; to Mrs. Herman L. Cochran, of La Muda; to Professor H. T. Cowles, of Mayagüez; to Mr. and Mrs. W. V. Tower, of Pueblo Viejo; to Mrs. F. W. Vaughan, of Bayamón; to Mrs. Robert A. Miller, of Ponce; to Miss Clara Livingston, of La Sardinera; to Mr. and Mrs. W. McKay Jones, of Villalba; to Mr. and Mrs. Harold I. Sewall, of Naguabo; to Mr. and Mrs. E. M. Ellsworth, of Cidra; to Messrs. Murphy and Clark at Villa León. Mr. Arthur S. Fairchild, of St. Thomas, communicated specimens and information from his important garden at Louisenhöj, and Mr. J. B. Thompson many records from the Agricultural Experiment Station of St. Croix.

Studies of the native flora were continued, with especial reference to rare or little-known species, and a few wild plants hitherto unrecorded for Porto Rico were detected; we also obtained more common names for a number of species. Mrs. Charles E. Horne, who has diligently prosecuted her artistic studies of native species, accompanied us on many occasions, increasing her noteworthy collection of water-color studies, now including over three hundred accurate and beautiful paintings. Some of these have been reproduced in several issues of The New York Botanical Garden's journal "Addisonia," and I wrote descriptive text to accompany eight more of them for publication there this autumn.

We were much interested in the soil survey of southern Porto Rico in progress while we were there by Mr. James Thorp and Don Gulielmo Torreuelles on behalf of the Sugar Planters; with Mrs. Thorp they accompanied us on several occasions; here there

are extensive areas of plains very little elevated above the Caribbean Sea, much of the land subject to saline influence and thus unavailable for agriculture; its drainage, or other improvement is a highly important problem. These saline or subsaline lands are characterized by a number of species of wild plants, which exist only under such soil conditions.

Don Gulielmo escorted us during one trip to the beautiful garden " Los Nisperos " at Tallaboa, a residence of Don Lucas Valdivieso of Ponce, located in nearly the most arid part of Porto Rico, where, through continued irrigation, luxuriant conditions had been obtained, including many very large trees of several kinds, the " Nisperos " (Sapodillas) being among the tallest seen by us anywhere.

Following a request by the editor of " Journal of the Cactus and Succulent Society of America," for a communication, as Honorary President of that association, I wrote, for publication, a descriptive account of the fifteen native species of Cactuses,[1] with special reference to their distribution in relation to rainfall, including data obtained from recent observations; I am indebted to Dr. Oliver E. Fassig, Meteorologist of the United States Weather Bureau at San Juan, for rainfall data at numerous stations in Porto Rico and the Virgin Islands.

The progress in reforestation of Porto Rico, under the active direction of Chief Forester Kramer is noteworthy. From the several Forest Service nurseries, about one million seedling trees, of various species, are now annually distributed, and their records show that some three times that number could well be distributed to advantage, when means are provided; requests for young trees from owners of estates and from corporations have largely increased, indicating expanded interest in forestry and appreciation of its importance.

In February, an examination of forest conditions and needs in Porto Rico was made by Mr. Joseph C. Kircher, District Forester, and Dr. R. M. Evans, Assistant District Forester, of the Federal Forest Service; we participated in dendrological discussions with them and in several field trips, in company with Mrs. Kircher and Mrs. Evans; their report and recommendation favoring large extensions of both the Federal and the Insular Government forests,

[1] Published in that Journal, 1: 226–231. Je 1930.

and the establishment of a Federal Experiment Station in Porto Rico, is a highly important contribution to tropical forestry. The Federal inquiry was extended to the Virgin Islands, through an examination of conditions on St. Croix, St. Thomas, and St. John, made by Mr. Kramer in April, and followed by an important report by him.

On Arbor Day, November 29, I took part in the planting, for the children of San Juan, of a young tree of "Cobana negra" (*Stahlia monosperma*), an endemic species of Porto Rico, now rare, symbolic of the need for reforestation[2]; this tree is valued for its nearly black, heavy wood; fortunately its seeds germinate readily and the Forest Service obtained several thousand seedlings last year. Quite a different condition obtains in another rare endemic tree, the "Hueso," or "Violet tree" (*Phlebotaenia Cowellii*), with hard, white wood, the seeds of which germinate very sparingly; we have searched and inquired of country people for young trees on many occasions, with no success, until in April of this year, one of the cattlemen at Llanos de Coamo brought us a single seedling found by him under one of the several trees existing in the beautiful arroyos of that estate. A few seeds germinated last year at the Agricultural Experiment Station at Mayagüez.

The permanent preservation of several relatively small natural areas of Porto Rico, illustrating various ecological features, through withdrawal of lands from private ownership is very important, supplementary to the large forest reserves. We have called attention to several of these areas, and, especially to the wooded valley traversed by the main driveway at Guajataca, between Quebradillas and Isabela; here the beauty and significance of the natural forest have recently been marred and further threatened by clearing the upper slopes, leaving patches of bare, white limestone. This charming valley is the only place in Porto Rico where the natural forest is traversed by a main road for any considerable distance, here for nearly half a mile.

Members of the Biology Department of the University of Porto Rico are enthusiastic field naturalists, making effective use of the published parts of the Scientific Survey. We participated in excursions organized by Professors Pagán and García and

[2] See Jour. N. Y. Bot. Gard. 31: 45–47. F 1930.

Mrs. Rachel Dexter and aided in their study and determinations of many plants.

The lichens of the region are, as yet, imperfectly and incompletely known. Very large collections have been made in former years, and studied by several investigators, but a comprehensive list of them has not been compiled. I took with me all the records of these studies, and as a contribution to the subject, arranged and reduced them in catalogue form, indicating over four hundred species at present known, but there are, probably, many more. We collected some additional specimens of interest on limestone south of Coamo Springs, and elsewhere.

The herbarium of the Insular Agricultural Experiment Station at Rio Piedras is a representative collection of Porto Rican plants, the only one in Porto Rico, very important for reference, and illustrating the Descriptive Flora and Plant Ecology published by the Scientific Survey. It has recently, under the direction of Dr. Mel T. Cook, been improved and augmented; we added a considerable number of specimens, and aided in the incorporation of many others. I made progress in writing a Supplement to the Descriptive Botany published in the fifth and sixth volumes of the Scientific Survey, planned for publication in the fourth part of the sixth volume, together with a comprehensive index to volumes five and six, prepared with much assistance from Mrs. Britton.

In February, a visit to Porto Rico was made by Professor L. R. Jones, accompanied by Mrs. Jones, and by Dean Russell, of the University of Wisconsin, on behalf of the Tropical Plant Research Foundation, for consultation with Commissioner Chardon, relative to many problems in Tropical Agriculture. We participated in field trips and in discussions. Conferences were also held with Mr. L. H. Dewey, Fiber Expert of the United States Department of Agriculture, who was inspecting fiber studies at Mayagüez, and with Mr. H. N. Vinall, Forage Crop Expert of the Department.

To aid the study by Professor William Trelease of species of the Pepper Family, for publication in "North American Flora," additional herbarium specimens were made, including a species determined by him as new to science, found by Mrs. Britton growing on a tree near the road from Guayama to Cayey; speci-

mens of the flowers and leaves of the native century plants were also obtained for his study of Agaves, supplementary to his monograph published several years ago by the National Academy of Sciences.

Entomological investigations in Porto Rico have recently been stimulated by the appointment of Dr. M. D. Leonard as Entomologist at the Insular Agricultural Experiment Station; we were in the field with him on several occasions, the inter-relations of insects and plants providing a fertile field for observation and discussion, much remaining to be made known. Dr. William T. M. Forbes, of the Department of Entomology of Cornell University, visited Porto Rico in April, especially for the study and collection of butterflies and moths; he has recently written up part of the Lepidoptera for publication by the Scientific Survey; he made large collections and obtained much additional information; we assisted him and mutually exchanged information about butterflies and plants. Professor Needham, also of Cornell University, visited Porto Rico in the course of an air-plane trip from Florida to Dutch Guiana, especially for the study of tropical dragonflies and was with us for a day at Coamo Springs, where he collected desirable specimens illustrating the life-history of some of these insects.

Archaeology, for the Scientific Survey, remains to be written, for publication in volume sixteen. To aid our Committee, we obtained some information relative to a number of collections of Indian implements and other objects available for study, and were privileged to see the very large series brought together by Dr. J. L. Montalvo, of Ponce, and the collection of Don Pedro Monclova at Coamo. We also visited some of the many sites of aboriginal villages; these sites, along and near the southern coast, have been mapped in detail by Dr. Montalvo.

Throughout, our experiences were delightful. The ample, truly wonderful driveways provide ready access to most parts of the island, and many of the country roads are traversible by small motor-cars. The tropical climate is enjoyable, tempered by the trade-wind, reaching summer heat through the middle of the day, but quite cool in the later afternoon, at night, and in the early morning.

N. L. Britton.

COFFEE

The term "coffee" possesses different meanings for different classes of people, in accordance with their varied interests in it. To the guests at table, it means a beverage ready for use; to the average housekeeper, the roasted and ground seeds of the coffee plant, ready for the percolator or boiler. The importer and wholesale dealer think of these seeds in their raw or unroasted state, marketed in coffee sacs, and he recognizes different classes of this raw product, according to the amount of preparation to which it has been subjected before he receives it. This also is the view of the medicine manufacturer, who uses the raw coffee, unless it is handled under the name "caffea tosta," when he expects to receive or to supply the roasted seed in the entire condition. If we go to the coffee-grower, we find him using the term coffee variously, as applied to the plants in his grounds, to the crop as gathered from them, or to the seeds as they are packed ready for the market. If we carry our investigation farther, we find that the numerous brands of coffee advertised for sale to the consumer differ greatly in the operations that have been performed upon them, in the mixture of various substances with the coffee, to change its special properties or perhaps to deceive and defraud the purchaser, or in the removal from it of one or more of its parts, with various objects in view.

The coffee plants of cultivation are large shrubs, mostly pertaining to the species *Coffea arabica* L. Several other species, notably *C. liberica* Hieron., have been cultivated to some extent. The total number of species in the genus is about twenty-five. They are mostly natives of Africa, although some pertain to other tropical regions. They belong to the family Rubiaceae, or the Madder Family, best known to our public by the little *Mitchella* or Partridge Berry and the various species of *Galium*. The *Cephalanthus* or Buttonbush is our one large shrub in this family. This same important family includes the ipecac plants, and also the Cinchonas, from which we derive our quinine.

The coffee shrub is now cultivated in nearly all tropical regions, although it does not do well in all of them, since its demands for suitable climatic conditions are quite definite and insistent. Not only do these conditions affect the health of the plant and the success of its culture, but they have a decided influence on the

FIGURE 1. *Coffea liberica* Hieron. A branch, showing leaves, flowers, and young fruits, reduced. From R. H. Cheney's book on "Coffee," by courtesy of The New York University Press.

character of the beverage yielded by the coffee. As the general rule, the finer grades of coffee, that is, those of finest aroma and flavor, are produced at high altitudes, while the lower elevations may produce coffee that is stronger in its nerve stimulating activity.

The writer recalls an occasion when, with two companions, he was riding through a mountainous region where coffee was cultivated, and stopped to seek a short rest with a planter whose house stood invitingly by the roadside. After a cordial greeting, our host, a complete stranger to us, whispered some instructions to a servant, who shortly reappeared with nine cups of coffee, three for each of us. Our host requested us to try them in a specified order, and then questioned us as to any differences of flavor that we might have noted. All three were quite distinct, as attested by all the guests. He then explained that all these grades were grown in his own grounds, the difference in flavor being due to conditions of altitude, soil, and exposure of the locations of growth.

Coffee is one of the most beautiful of shrubs, at any stage of its development. With neither flowers nor fruits, it is a lovely foliage plant, its leaves being abundant, symmetrically placed in pairs, broad and thick, and of a deep-green color, with a glossy lustre and general waxy appearance. The flowers occur in clusters in the axils of the leaves, each resembling a small *Gardenia,* usually of a snowy white color and thick luxurious texture. They are delightfully fragrant, and are followed by oval fruits about as large as peanut kernels, and of a color changing from green to red and yellow as they ripen. Occasionally we may see a wand-like branch, perhaps two or three feet in length, densely clothed with a succession of products, quite ripe fruits at the base and opening flowers at the summit, with intervening fruits in all stages of maturity. The shrubs are planted, often on a steep hillside, in regular rows. When such a plantation is viewed, with its branches swaying in a gentle wind and the sunshine glistening from its rich waxy leaves, the effect is most intriguing.

Technically, the coffee fruit is a two-stoned drupe. The outer fleshy portion, or sarcocarp, is of rather firm consistency and is not edible; nor has any important use been found for it. The two stones or putamens fit closely together by their flat sides, so that the two together have the same form as that of the fruit. Their shells are not thickened and hard, as in the plum or peach, but are chartaceous or parchment-like, and thin. They must be removed before the coffee is roasted and prepared for use. To the dealer, this putamen is known as the "pod." In the flat face of each putamen there is a deep longitudinal furrow, which is

also found in the face of the seed after the putamen is removed. The texture of the seed is hard and tough.

The coffee fruit should be fully ripe before being gathered. The first operation is the rubbing off of the pulp. This in a large plantation is done by machine, but the man with a few plants, grown to supply his own wants, usually employs a smooth stone or a piece of hard wood, with which the fruits are abraded in a wooden bowl or trough. After the stones are washed and dried, the coffee is ready for shipment, usually in bags specially

FIGURE 2. *Coffea arabica* L. A drooping branch, showing nearly mature fruits, much reduced. (Photo taken in Porto Rico by M. A. Howe.)

made for the purpose. The putamen or pod is sometimes removed at the place of production, although not usually. When this is not done, the commercial designation of the coffee is "coffee in the pod." After its removal, it is sold as "podded" coffee and then its keeping properties are not so good.

The quality of raw coffee deteriorates with long keeping, but this effect may be greatly reduced by keeping it closely protected against the atmosphere. In such cases, great care must be taken to keep it dry, as it readily becomes mouldy. The flavor of coffee deteriorates still more rapidly after being roasted, so that many

housekeepers prefer to purchase raw coffee and to roast and grind it just before using. However, even ground roasted coffee will retain its flavor very well for a long time if packed tightly in air-tight jars, such as fruit jars.

The coffee with the pod removed constitutes the seed itself and this possesses its own covering, the testa, which is closely adherent to the kernel. This may or may not be removed before roasting. Such removal is effected by abrasion, rotating the seeds in a tumbling barrel. This process is known as "washing" and coffee so treated is sold under the name "washed coffee." If this is not done before roasting, this outer membrane will separate in the roasting process and will flake off as a sort of chaff, which must be winnowed out.

It must be understood that unroasted coffee has none of the fragrance and flavor for which the article is valued, these being developed by the production of new substances in the coffee by the roasting process. We must therefore next consider the constituents of this interesting seed.

The relative quality of any coffee is determined partly by its flavor and aroma and partly by its strength, the amount of coffee used being, of course, the same in any comparison that is made. By the "strength" of coffee, we mean its power to produce the characteristic effects on the system after drinking it. This effect is produced by the alkaloid caffeine, the amount usually being between 1 and 2 per cent of its weight. The amount of caffeine can be readily determined by chemical analysis or assay. This assay will ordinarily yield a larger percentage after the coffee is roasted than before, but this is not due to any actual increase in the amount, but to the fact that the caffeine is more readily and completely extracted after the roasting. The substances that give the odor and flavor, on the other hand, are not present in the coffee before it is roasted. In that state it contains about 15 per cent of sugar, 13 per cent of fat, and a variable amount of tannin, with other substances in less amount. Under the influence of the roasting, the chemical composition of these substances is destroyed and new substances are formed from them, which are volatile, giving the aromatic odor, and also imparting the peculiar taste for which the coffee is valued.

As a rule, coffee that is strong in caffeine is less fine in odor and flavor, so that the practice of mixing or "blending" different

sorts is commonly employed to yield a product that combines all the different qualities that are desired. In the more elevated regions, like the high mountains of Jamaica, Guatemala, Colombia, Bolivia, and Arabia, coffee of exquisite flavor is produced, which brings very high prices. Some of these coffees, from the most favorable localities, are not found in the general market, being completely subscribed for in advance of production, by special

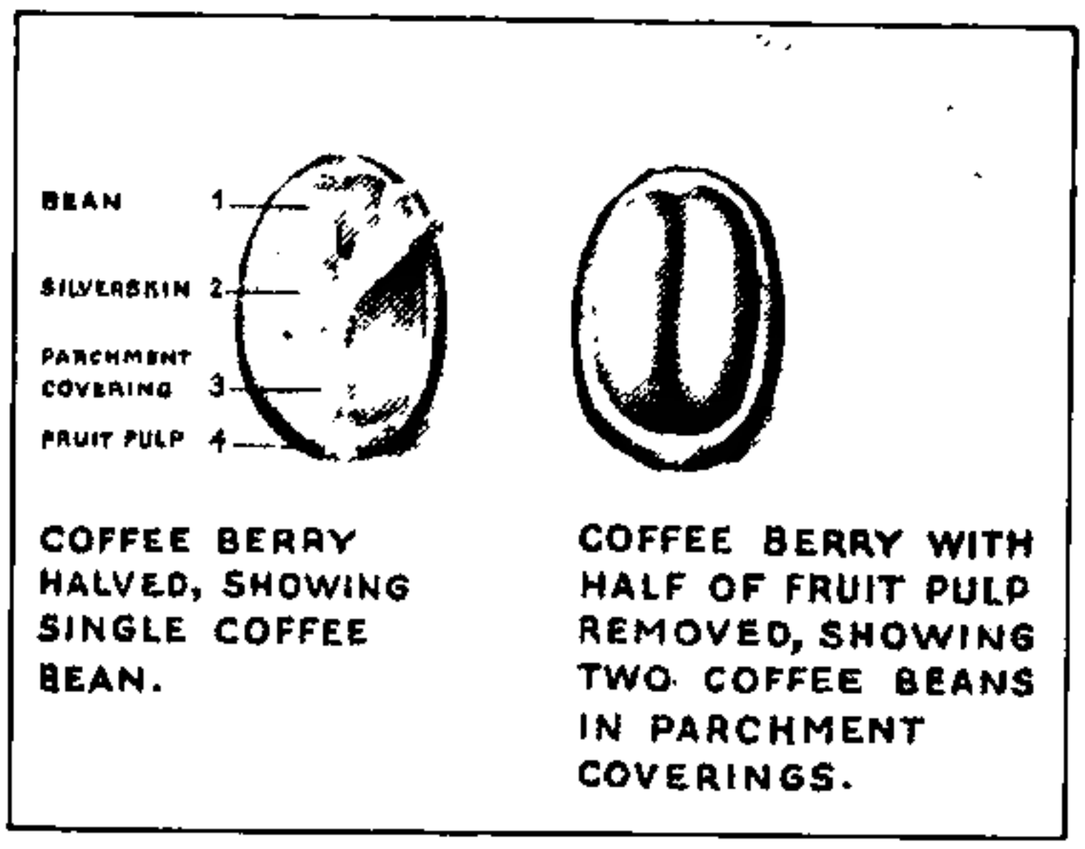
BEAN 1
SILVERSKIN 2
PARCHMENT COVERING 3
FRUIT PULP 4
COFFEE BERRY HALVED, SHOWING SINGLE COFFEE BEAN.
COFFEE BERRY WITH HALF OF FRUIT PULP REMOVED, SHOWING TWO COFFEE BEANS IN PARCHMENT COVERINGS.

FIGURE 3. Sketches, showing structure of the coffee berry or fruit. By courtesy of The Brazilian-American Coffee Promotion Committee, through Professor Ralph H. Cheney.

customers. About the best coffee that is in abundant commercial supply and readily obtainable is probably Medellin coffee, shipped from a Colombian city of that name. Almost equally good is Bogotá coffee, from the same country. Most Brazilian coffee, produced at relatively low altitudes, is very strong, that is, rich in caffeine, but of rank and inferior flavor. The well-informed coffee-buyer pays no attention whatever to the common trade-marked brands nor to the advertisements concerning them, but orders by the geographical names, such as those given above. Unfortunately, in the present depraved state of our trade, one has little assurance of getting what he pays for, unless he buys from some specialist in coffee, whose integrity can be relied upon.

Although a lot of samples of coffee may be quite indistinguishable to the average individual, the coffee expert knows at a glance the country of origin, the quality or grade, and the proper price. He can do the same thing also by tasting the coffee as prepared

for drinking. Men who do this as a business are known as coffee-tasters.

The skill of these expert tasters and the accuracy of their conclusions was well demonstrated at a recent competition held in New York City. Forty-eight different commercial brands of coffee were tested by eight experts, the tests extending over three sessions on three succeeding days. All the samples were percolated in the same way, by the same cook. The samples were so numbered that no taster knew what coffee he was tasting. Two tests were made at each session. In all of the tests, the same brand of coffee came out first, and another one came last in all cases.

The aromatic and savory principles of coffee have little influence in affecting the general physiological activity of the system, but this is by no means true of the caffeine that we imbibe in it. This produces profound effects upon the human system, in various ways, being capable of great service as a medicine, or of causing injury or even death if employed in excess or at a wrong time. Its direct effects are almost wholly upon the nervous system, but through the action of these nerves important secondary effects are produced on other organs. Both the activity and the strength of the heart are promptly increased, giving a better blood supply throughout the body, especially in the brain, with increased energy and activity and a great reduction in the sense of weariness and fatigue, when these exist. Increased activity from this cause is especially noticeable, and very prompt, in the work of the kidneys, and in this way there is an increased removal of waste products from the system. There is also a marked tendency toward a condition of comfort and cheerfulness. The most valued effects, especially when the quantity taken is considerable, are those on the intellectual faculties. Caffeine is one of the very few things that genuinely stimulate intellectual activity as a whole. Such things as alcohol appear to stimulate, because they upset the mental equilibrium, and produce an active mental disorder, whereas caffeine stimulates all the faculties equably, producing a greater amount of mental work of natural, or even superior quality. Herein lies the great temptation to excessive coffee-drinking by intellectual workers, who are often compelled to continue mental activity beyond the point where the system demands rest for the safety of the nervous system. As a temporary emergency

measure, this stimulation may do, the extra effort being compensated by a corresponding resting period thereafter. The natural temptation, however, is to abuse the assistance thus secured and to continue to bend the intellectual bow farther and farther, until it snaps or refuses to come back to its natural and efficient state. Thus, coffee may become a habit-forming drug, although not in the same way nor to the same extent as articles of the narcotic class, which affect the intellect unequally. The result of excessive coffee-drinking, reducing the desire for and the ability to sleep and stimulating the amount and intensity of mental activity, if long continued, eventually brings on a condition of insomnia, nervousness, inability to carry on sustained effort, and other results which are quite the opposite of those produced by its moderate use. Carried still farther, there occurs a condition of inability to use the muscles in a normal way and this condition extends to the muscles of the heart.

The strictly medical uses of coffee and caffeine can not be taken up here, but they are very important, and would be much more so if coffee were not used habitually, so that its medicinal effects have become to some extent prevented. The medicinal dose of caffeine is one or two grains, and this is about the amount in an ordinary full cup of coffee of average strength.

All that has been said of coffee applies also to tea, which, ounce for ounce, contains about twice as much caffeine as coffee. This alkaloid is also contained in much larger amounts in guarana, the national beverage in northern Brazil, in cola seeds, used in tropical Africa, in matté or Paraguay tea and in cassine or dahoon, of the southern United States, which was a much used beverage and an important article of commerce among the aborigines, when they inhabited that country. Because of the tendency to acquire a habit of excessive coffee-drinking, many persons have adopted the use of coffee from which most of the caffeine has been extracted, this process not seriously impairing the flavor of the coffee.

The adulteration of ground coffee, by the addition of various subtances, has been carried on to an enormous extent. Many substances have been used for this purpose, beans and chicory root probably having predominated. It is a notable fact that after a person has long been accustomed to the use of one of these adulterated coffees, he may acquire a taste for it to such an extent that he no longer cares for the pure product.

H. H. Rusby

PLANT LIFE SOUTH OF THE ICE FRONT DURING THE GLACIAL EPOCH*

One of the many questions frequently asked of the geologist is in relation to the kinds of life—animal and vegetable—that existed south of and in the vicinity of the ice front at the time when the great continental glaciers of the Glacial Epoch or Ice Age of the Quaternary Period covered practically the entire boreal and north temperate parts of North America and Europe.

We have learned considerable about the animal life—the mammoth, mastodon, woolly rhinoceros, cave bear, giant sloth, etc.—but we know comparatively little about the contemporary vegetation. It should be said, however, that search for the remains of this vegetation, and its study, have been carried on in the Old World to a much greater extent than in America.

There is ample evidence that the glaciation was not continuous. There were several advances and recessions of the ice. A glacier advances by the actual movement of its mass; but when it recedes it does not move backward. Recession simply means that its front is melting away more rapidly than the mass is advancing. Where this condition obtains, it manifestly indicates warmer climatic conditions than previously prevailed. Hence we infer that the Glacial Epoch included periods of cold with warm or temperate periods intervening.

Throughout the glaciated region of the Ice Age all forms of life were frozen or ground out of existence; but close to the ice front—if we may judge from conditions close to many existing glaciers—plant life was in existence and plants followed everywhere in the wake of the ice front wherever it receded.

Remains of the vegetation of the Ice Age have been preserved in the silts of glacial lakes and ponds, in the morainal débris along the line of furthest ice advancement, and in swamps and lowland areas beyond, which were buried beneath deposits of sand and gravel transported by streams from the melting ice-front.

In Maryland, for example, we find old swamps buried under successive layers of gravel, sand, and clay that represent the sediments transported from the north. The plant remains, preserved

* Abstract of an illustrated lecture delivered at The New York Botanical Garden, Saturday afternoon, March 15, 1930.

in the form of peat and lignite, show that the vegetation then in existence there was almost identical with that of a modern cypress swamp, such as the Dismal Swamp of Virginia. Evidently at this distance south of the ice front—which, in the eastern part of North America, reached its furthest southern extension at about the latitude of New York City—the climatic conditions were about the same as they are today.

Close to the ice front, we have evidence of cooler climatic conditions. Leaves of poplars, birches, ericaceous shrubs, etc., are frequently found in the sediments of glacial lakes and ponds that were topographic features of the period; and now and then the leaves and cones of coniferous trees that are typically representative of northern regions. The genera are all identical with those now in existence, and so also, apparently, are most of the species.

The lecture was illustrated by lantern slides of maps that showed the glaciated areas of Europe and North America, views of modern glaciers, localities where plant remains of the Ice Age have been found, photographs and drawings of many of the fossil plant remains, etc.

ARTHUR HOLLICK.

THE TREES AND SHRUBS OF GREATER NEW YORK*

The total area of greater New York, comprising the five boroughs of Manhattan, Brooklyn, Bronx, Queens, and Richmond (Staten Island) is larger than many people realize. Its 315 square miles are equal to about one fourth of the area of the state of Rhode Island. This large area is by no means all thickly settled. There are many sections still awaiting development, and fortunately large tracts have been reserved for public parks. With the growth of the city in years to come, these public parks will contain the sole representatives of our native flora, and it is important that as much of them as is practicable be preserved in its natural condition. Parts of Central Park, especially near its north end, have been left in this wild state; also, Pelham Bay Park and Van Cortlandt Park in the Bronx together cover nearly 3000

* Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, June 21, 1930.

acres, much of them in a state of nature. It is very important that this policy be continued. In Manhattan another beautiful wooded area is the new Inwood Park. Around Flushing there are localities of interest to tree-lovers, and Kissena Park preserves many rare, exotic specimens that were originally nursery-grown. The terminal moraine north of Jamaica and Hollis is another interesting region. But the greater amount of wild land in the city may still be found on Staten Island, and we hope the present movement for enlarging the park system there will prove successful.

From a botanical standpoint the Greater New York area is of great interest because it is the meeting place of more southern species such as Sweet Gum, Willow Oak, Persimmon, Black Jack Oak, Virginia Pine, etc., with more northern species such as Sugar Maple, Beech, Yellow Birch, Hemlock, etc. On this account the area shows an unusually large variety of native species.

Nine species of oaks and four kinds of hickories are common in the Greater City and can readily be distinguished with a little practice. The birch family is also well represented. Altogether, over 150 species of trees and shrubs are of fairly common occurrence.

The effect of the gas and smoke from automobiles (*automobilosis*) on the street trees has become a serious problem. Most trees along much-traveled streets show their leaves on the lower limbs blackened and curled around the edges. The London Plane and Oriental Sycamore, as well as the Ailanthus, seem to withstand these noxious gases and the dust and smoke of the city better than any other tree species.

ARTHUR HARMOUNT GRAVES.

NOTES, NEWS, AND COMMENT

On June 21st, Dr. Fred J. Seaver gave a lecture on "Fungi, Edible, Poisonous and Otherwise Interesting" before the Boston Mycological Society under the auspices of the Massachusetts Horticultural Society. The lecture, which was given in Horticultural Hall in connection with a Flower Show, was well attended and considerable interest was manifested by the members of the Club.

Among the visitors who enrolled in the library during the spring were the following: Mr. Harold C. Bold, University of Vermont; Dr. I. M. Johnston, Cambridge, Mass.; Dr. Alfred Rehder, Jamaica Plain, Mass.; M. Louise Sawyer, Wellesley, Mass.; Prof. Alexander W. Evans, New Haven, Conn.; Mr. Aretas A. Saunders, Fairfield, Conn.; Prof. George H. Shull, Princeton, N. J.; Mr. S. H. Burnham and Dr. Donald Reddick, Cornell University, Ithaca, N. Y.; Mr. E. P. Killip, Prof. Charles S. Parker, Mr. C. A. Reed, Mr. Knowles Ryerson, Dr. Walter T. Swingle, Mr. H. L. Westover, and Dr. Edgar T. Wherry, Washington, D. C.; Frère Marie-Victorin, Université de Montreal; Dr. Rafael A. Toro, Bogotá, Colombia; and Prof. Y. Asami, College of Agriculture, Tokio, Japan.

Mr. William Cashman Ferguson, a life member of The New York Botanical Garden and a critical student of the flora of Long Island, died at his home in Hempstead, New York, on June 3. Fifteen charitable and religious institutions are beneficiaries in his will. His herbarium, said to be the most complete private collection of Long Island plants in existence, is given to The New York Botanical Garden, together with his botanical notebooks and records and the sum of $4,000 to be expended for suitable cases and for the proper mounting and labeling of this collection in connection with installing it in the Museum Building of the Garden.

Dr. N. L. Britton has been elected Honorary President of the International Desert Conservation League, a recently organized association in California "to respond to an urgent demand for the protection of desert plant life and the conservation of desert

beauty spots in the form of park areas containing rare desert flora and fauna." Mrs. A. Sherman Hoyt, of Pasadena, is the Founder and President of this League; her great interest in desert vegetation will be recalled by many who viewed the exhibit of Mojave Desert plants made by her at the International Flower Show in New York in 1928, and subsequently presented to The New York Botanical Garden and installed in Conservatory Range No. 1, where it continues to instruct many thousand visitors annually. Mrs. Hoyt set up another exhibit at the London Flower Show in 1929, and this was presented by her to the Royal Botanic Gardens at Kew. In a conservation number of *The Western Woman,* Mrs. Hoyt publishes an appeal to all conservationists and friends of the desert, with long lists of vice-presidents of the new League and of members of an advisory board.

Meteorology for May. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 86 ½° F. on the 2nd; *95½° on the 7th;* 81° on the 13th; and 90° on the 23rd. The minimum temperatures recorded were: *37° on the 12th;* 48° on the 15th; 43° on the 26th and 42° on the 27th. The total precipitation for the month was 3.27 inches.

Meteorology for June. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 79° on the 1st; *95° on the 4th;* 87° on the 15th; 87° on the 21st; and 94½° on the 25th. The minimum temperatures recorded were: *52° on the 3rd;* 57° on the 11th; 60° on the 21st; and 55½° on the 30th. The total precipitation for the month was 3.02 inches.

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Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

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The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

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THE PHILIPPINE ISLANDS
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NOTES, NEWS, AND COMMENT

ACCESSIONS

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BOTANICAL EXPLORATION OF BORNEO

The flora of Borneo, essentially of the same type as that of the Malay Peninsula, Sumatra, Java, the Philippines, and other islands of the Malaysian region, is an exceedingly rich and varied one. Endemism is highly developed, as in other parts of this vast region, probably fifty per cent of the species occurring in Borneo being confined to that island. In area Borneo approximates 290,000 square miles, considerably over twice as large as the British Isles. Its greatest length is about 830 miles and its greatest width is about 600 miles. Much of its area is mountainous, the ranges culminating in Mount Kinabalu in northeastern Borneo, with an altitude of nearly 13,500 feet, the highest peak in Malaysia outside of New Guinea.

Nothing was known regarding its flora until about 1840, when Korthals made rather extensive collections in the southern part of the island. At the present time, in spite of a very considerable amount of field work and numerous scattered publications aggregating about 600 titles, its flora is most inadequately known, probably less than one-half the species that actually occur there being known to science. In the ferns alone about 700 species are known, and it is estimated that this is but about 60 per cent of the number that actually occur in Borneo. In the flowering plants, between 5500 and 6000 species are recorded, certainly not over one-half of the species that occur naturally in this great island. This known flora of approximately 7000 species may be compared with that of the British Isles, about 2000 species, by way of indicating the richness of a tropical flora as compared with that of a temperate region.

The great extent of country; the high temperatures and humidity; the variation in the seasonal rainfall in different areas, some regions being constantly wet, others subject to alternate dry and wet seasons; the great range in altitude, and other factors combine to produce conditions in this great-equatorial island most favorable to the development of an exceedingly rich and diversified flora, conditions that can scarcely be duplicated outside of the humid equatorial regions.

While botanical exploration of surrounding regions, such as in the Malay Peninsula, Java, and the Philippines, has progressed rapidly, less attention has been given to the flora of Borneo, one that is as rich or richer than those of the three regions mentioned above. The reasons are that Borneo up to the middle of the last century supported no permanent European towns or colonies; the country even today is but slightly developed agriculturally, industrially, and commercially; and except near the few, rather small, and widely scattered settlements, roads do not exist, all transportation being by the sea, river, and inland trails. Travel and exploration in the interior is naturally difficult, and to reach remote points one must be endowed with courage, fortitude, and initiative, and be blessed with the spirit of the pioneer. Vast stretches of country in the interior are unknown in geographical detail, and equally unknown biologically.

Botanical exploration of Borneo was actually commenced about 90 years ago by Korthals. Among the important collections may be mentioned those of Beccari, Lowe, Motley, Barber, Lobb, Burbidge, Teysmann, Creagh, Fraser, Hallier, Haviland, Hose, and others made in the period between 1840 and 1900, and since the beginning of the present century those of Nieuwenhuis, Schlechter, Winkler, Foxworthy, Miss Gibbs, Mrs. Clemens, Ramos, Topping, and Elmer, and the important series assembled by the personnel of the British North Borneo forestry service. The Elmer collection from British North Borneo, the only one that has been thoroughly studied as a whole, contained about 900 species, of which 237 were new; and this collection was made within 10 miles of the coast and below an altitude of 2000 feet.

In 1929 Chaplain and Mrs. Joseph Clemens, who had previously made most important collections on Mt. Kinabalu, British North

Borneo, in connection with their ascent of that mountain in 1915, made extensive collections over a period of nearly six months in Sarawak. The regions visited were Kapit and Gat on the Rejang River, Mt. Poi, Mt. Gadin; and also Mt. Matang and Bidi Cave, near Kuching. The collections approximate 3000 numbers, and this material is now at The New York Botanical Garden, where Chaplain and Mrs. Clemens have been engaged in sorting, arranging, and labelling the specimens as a preliminary step to the distribution of the sets of duplicates. The labels are now being completed and the duplicate sets will be distributed this fall. The collection is one of the largest and most important ever made in Borneo and will add materially to our knowledge of the flora of that great island.

The botanical collections made by Mrs. Clemens in the past 25 years exceed 20,000 numbers. Very extensive field work has been done by her in various parts of the Philippines from northern Luzon to southern Mindanao and the Sulu Archipelago, and including many of the highest and most inaccessible mountains, such as Apo in southern Mindanao and Pulog in northern Luzon, both about 10,000 feet high, Moises, Pinatubo, Data, Pauai, Tonglon, and others in excess of 7000 feet in altitude; in British North Borneo; in Chihli and Shantung provinces, China; in Anam, French Indo-China; and in various parts of the United States, especially California, Utah, Oklahoma, and Texas.

The following extracts from a letter written by Chaplain Clemens, November 9, 1929, at the close of the field work in Sarawak give some idea of the conditions under which the work was done:

Singapore, November 9, 1929.

"We sailed from Singapore May 15, 1929, for the Rejang River, Sarawak, reached Sibu the 18th, and Kapit, the beginning of the hills, May 24th; by steam boat, one and a half days. Here, by the kindness of the District Officer, we were provided with a comfortable bungalow and commenced collecting in earnest, drying the plants over a charcoal stove made from a Standard Oil can. By this means, and utilizing the sun to dry pads, plants were immortalized in from two to three days. We collected here for about a month and then proceeded to Gat on the Upper Rejang, which we reached after nearly two days battling against the swift river. . . .

" In three days the river had risen fifteen feet, so that we could not cross to the 3000-foot moutain where we wished to botanize. But just back of the house is another mountain from which we brought loads of plants. Then we began on the mountain across the river. When I went alone with Dyaks, all was well, but when the Lady and two Dyaks of the family who had sworn to cut off my head, went, the lover of flowers and mountains saw so many things new and wonderful to her, that I wished for a rope around her to drag her along. I should explain that by a glittering present I had so mollified the anger of the offended Dyak that he and his family became our most eager helpers. When they went to the mountains with us we paid them ten cents extra, *i.e.*, sixty cents silver. One day I was lost by following the wrong deer trail, but only for an hour or so.

" July 29, 1929, we were rowed down to Kapit by four Dyaks in a boat so laden as to bring the water within four inches of the valuable collection, which made my Lady frantic lest the water should wet them. Some of them did get wet at the rapids, where we walked, and others by the heavy rain that caught us as we reached Kapit. Here I lay with all my bones broken by dengue fever, so that when we reached Kuching on August 18, 1929, the residence of the Rajah of the most highly favored land of the many to which our strange wanderings have led us, I was so debilitated that I was kept in the hospital for a week. During my reveries in the hospital, it occurred to me that our coming to Sarawak ought to be of some benefit to the country, and when I was favored by an interview with Rajah Brooke, I explained to him that it was impossible for a person with limited means to do justice to even the limited expedition we had in mind, and asked for his coöperation, by sending with us men to be trained in the art of making botanical specimens. He was interested in our project and issued orders to have us taken to any place, and that men be furnished to carry our outfit.

" Your request that we interest ourselves in Mount Poi sent us to Lundu, in a government launch, September 4, 1929. Here about thirty men were ordered to carry forward our things, and in four days we were settled in the Lower Cave camp, after the labors of three relays of carriers. This I estimated to be at an elevation of two thousand feet.

" No, it was not a comfortable home, although we occupied it for a whole month. In fact it was beneath a huge rock, with a domelike roof, which let streams come through when it rained, and it rained nearly every day. We placed all available pails to catch the water so it would not form a lake under our cots, and tried to keep the charcoal fire under the plants piled about our Standard Oil can stove. This plan caused us some excitement one

morning, when Lady gave an insistent call for me to come and help get a specimen from a tree she could not climb. On our return we found the cave full of fire and smoke, and we lost eight presses of plants, most of which I had brought from the top of the mountain, besides much of our valuable collecting material.

"That experience led us to construct a canvas drying-room under the shelter of a nearby rock. The interior had two pole platforms, one above the other, so that the presses, two deep, could be placed on edge over the fire. It held over twenty presses, besides leaving room for the papers and driers; for everything became damp and soggy in a few minutes outside the driers, because the trees rose more than a hundred feet above and about us, and we seldom got a ray of sunshine.

"The first time I attempted to go to the top of the mountain, my guide was taken sick and I went on up alone. I thought I had reached the top and collected plants enough to carry, when a shift of the cloud showed the mountain top much further on. On my way down I took the wrong spur and finally found myself looking up at the long spur I had ascended, far above, to my right. I climbed back over and about granite rocks as large as houses. The thunders roared, lightnings flashed, and rain poured; while rattan hooks and numerous other prickly vines tore my clothes and skin. It became almost dark, and I felt sure of spending the night under a tree. I came to a good shelter, beneath a huge rock, but one could not live and rest with such wet clothes. At last I reached the trail, started down and had gone but a short distance when I overtook my sick guide. Happy meeting it was. We searched our way down, but darkness settled over us and still more darkness. Just as we could but feel our way, my call was answered by my anxious wife. I found my way to the cave, was soon supplied with dry clothes, and refreshed with warm bovril broth; the scratches were healed by germicidal soap and mentholatum and life was once more worth while.

"To explore the upper part of the mountain more efficiently we transferred to the upper cave. It required about five hours to climb to the upper cave over the long granite ridge. This was more comfortable, as the drying rack was just by the sleeping place. Here we slept for three nights, sending plants, in press, to the lower camp. But the rain poured on us each time we went to the top, about two hours steady climb from the cave. What a variety of trees, shrubs, and terrestrial plants we spread on the rack, over the fire on our return! These were soon trimmed, labelled, and put in press to dry, and to expedite drying we maintained a fire of green logs all night. . . .

"On October 6th we descended to the chief's house at Sabaku, and the next day we went twenty miles on foot to Lundu. What

a mountain is Mount Gadin, immediately back of Lundu, with its many waterfalls and unending variety of ferns, orchids, arums, palms, and almost numberless other kinds of plants! Here we spent four nights; the Lady says we could have spent a year to advantage. But the government launch was sent for us according to arrangement and we puffed our way into Kuching Harbor on October 12.

October 17th we were taken by automobile a distance of 25 miles to Bidi Cave. Two hundred feet of ladder had been made that the Lady might ascend to make camp in the entrance of the cave. We were told that we could not reach the top of the mountain, because of the perpendicular sides, but Lady said she had seen a far light on her exploring trip through the cave. Next day I took helpers with lanterns and went about a quarter of a mile through the cavern, where we found an opening to the outer world, from which we could botanize all over the top, the spurs, and into the mighty bowls formed in the limestone of which the mountain is composed. The collection will show the great number of strange plants secured. The strangest, perhaps, is the huge-leaved *Moultonia,* which is known from this cave alone.

" One evening the rain began to pour in streams into the valley and this was followed by a strong wind that came around the corner with such velocity as to crash trees more than a foot through into fragments and pile them into a heap at the foot of the precipice.

" Five days were spent in this enchanting place, when the autos came to take us to Kuching, and the third day afterward we were taken to Mount Matang, where a crowd of Tamils carried our outfit to the Rajah's bungalow. This is constructed on the site where Beccari, the great naturalist, built his house in 1868, near a beautiful waterfall, at an elevation of eight hundred feet.

" What a comfortable bungalow is Valombrosa! We should have spent at least a month on that beautiful mountain, to the top of which is built a well-graded trail, passing by many waterfalls, beneath cliffs, and overhung with a variety of jungle trees, so numerous as to put one in a maze to know what first to collect, besides the great variety of palms, ferns, orchids, and ground-loving plants. On the day we two went to the summit with two men to carry our great bundles of plants, we brought down about one hundred species. What work it was to trim, label, and hand them over to two trained men to put into presses. We filled all the presses and then made extra bundles, until all our papers and driers were used, and then put still others into bags to carry the next day to Kuching.

" It should be noted that the Rejang River region is mostly a sandy and clay land, which is being rapidly set to rubber trees.

Poi Mountain is granite, and thus by its piling up many huge rocks, forms ideal nooks for a varied flora. Bidi Cave Mountain is altogether of limestone, and all botanists know what that means to collectors in multiplying species. Matang Mountain is of sandstone, that washes away so fast that in a large tea garden the bushes soon had their roots standing like the legs of straddle bugs bearing the plants.

"We pronounced the expedition to have been a glorious spree. Drunk? Yes, that says it. We were drunken with the excitement of the great numbers and variety of species which leaped out at us from every nook along the trails, and from behind or down from every tree of forest or field. . . .

"Our friends tried to dissuade us from making the arduous trips to the Upper Rejang, and to Mount Poi. I surely did feel the weight of my sixty-eight years when I lay on a cot suffering from dengue fever on the deck of the vessel that bore us to Kuching, but the week in the hospital, and the tender care of the lady in charge of the rest house, placed me on my feet once more.

"I hope we did as much for the benefit of botany in Sarawak as its wise ruler did to help forward the success of our expedition. Yet, we feel that we did but 'touch the hem' of the robe of rich verdure that covers the beautiful country of the much-loved Rajah. May I be permitted to deviate so much as to say that we found the natives the richest and most contented of the people of any of the many lands we have visited in our years of wandering in search of things that adorn the earth.

"Yes, it is a strange manner of holiday diversion; especially when we have only the love of wild places as our excuse for doing it, but I married a wife, and she owns part of the time, and chooses this manner of playing the game—and why not?" [Signed, Joseph Clemens.]

E. D. MERRILL.

NOTES ON BOXWOOD TROUBLES

When owners of estates place a value of from fifty to a thousand dollars or more on a clump of the bushes, boxwood must be considered as an aristocrat of ornamentals. It is one of the hardy shrubs rather resistant to disease and endowed with such recuperative power that individuals often attain great age. There are a few insect pests and fungous diseases, however, which, if unchecked, can work some havoc. They may leave what was once the pride of an estate an ugly thing which, if it were any other shrub than box, would be condemned to the brush pile.

The prevalence of certain box troubles in the vicinity of New York have been brought to our attention during the past two years. A brief note as to their nature and control may be of interest at this time.

The Boxwood Leaf-miner, Monarthropalpus Buxi Labou

The leaf-miner is one of the most common and destructive of insect pests of box. Certain varieties are less subject to attack than others, but this year the narrow-leaved varieties at The New York Botanical Garden and vicinity have been the most heavily infested. The leaves are normally a beautiful dark green, but those infested with the miner in previous years turn brown, and the leaves of last year now containing the young miners show the disfiguring yellowish flat galls characteristic of the work of the insect (Fig. 1, D, 10, 11).

The adult miner is a fragile two-winged fly or midge somewhat less than one-eighth of an inch long, with deep orange body and legs[1] (Fig. 1, D). The female deposits her eggs within the young leaves in early spring (Fig. 1, A). The spots where the ovipositor has penetrated appear as thin transparent pin-points when a leaf is held up to the light. The eggs hatch in about three weeks and the young larvae feed on the tender leaf-tissue during the summer.[2]

During the spring months of the next season, swollen yellowish to brownish galls appear on the leaves containing the developing larvae. An abnormal growth of the host cells has occurred, said to be caused by an enzyme secretion of the larvae. If the leaf epidermis is carefully removed or the leaf is broken open by bending double, an active yellow-orange larva about one sixteenth of an inch in length will be found (Fig. 1, D, 14). A few weeks later this larva becomes a less active pupa, with head parts turning progressively darker until they are almost black (Fig. 1, D, 15). The adults begin to emerge very soon after this stage is reached. The pupa pushes out through the lower epidermis of the leaf about half its length, then leaves the case and flies away after

[1] Weiss, H. B. Insect enemies of greenhouse and ornamental plants. N. J. Agr. Exp. Sta. Circ. 100: 9–11. 1918.

[2] Hamilton, C. C. The boxwood leaf-miner. Md. Agr. Exp. Sta. Bull. 272: 143–170. 1925.

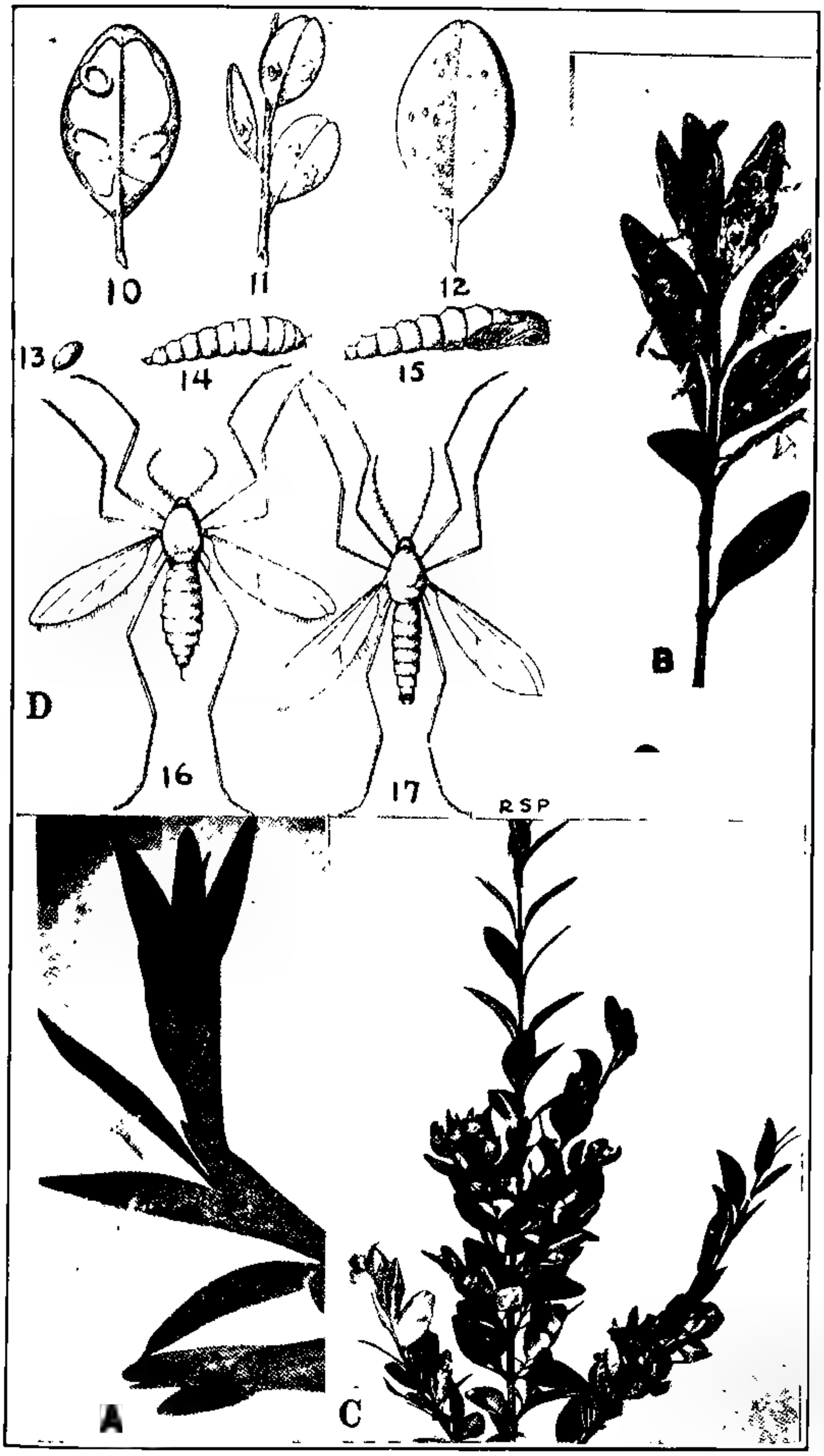

FIGURE 1. Box-leaf Miner and Psylla leaf-curl. A, B and C from Hamilton; D from Weiss.

about three minutes. If one shakes a bush a few days after the insects have emerged, hundreds of the little chaffy pupa cases are dislodged and float away (FIG. 1, B).

Control:

The leaf-miner may be readily controlled by application of a contact insecticide to which black strap or other cheap molasses has been added. Middleton and Smith,[3] of the Bureau of Entomology of the United States Department of Agriculture, recommend the following preparation:

1 gallon of heavy stock-food molasses.
6 gallons of water.
10 teaspoonfuls of 40% nicotine sulfate.

Hamilton,[2] of the Maryland Agricultural Experiment Station recommends a somewhat more concentrated mixture:

1 part of stock-food molasses.
4 parts of water.
1 part of nicotine sulfate to 500 parts molasses and water.

The important thing is to prevent the adult female from laying her eggs, and thus eliminate next season's generation. The molasses prevents the fly from leaving the leaf from which it emerges and the nicotine sulfate acts as a poison. The first application of the mixture should be given just before the pupae begin to emerge. The dates of development and emergence of the fly vary according to latitude, season, and temperature. Hamilton[2] states that at Baltimore the adults start flying usually from May 10 to 15, but that the time may vary from the latter part of April to the latter part of May.

At The New York Botanical Garden, old yellow leaves with brown galls were observed in June of 1929. The telltale transparent spots on the new leaves indicated that the work of the flies had already been done for the season, but during the spring of 1930 careful inspection was made of the bushes from day to day in order that the adults might be eradicated as soon as they appeared. On April 15, 1930, the swollen galls were examined and found to contain yellow larvae. During the first week in May the larvae were pupating, and on May 15 the adults were first seen

[3] Middleton, W., and Smith, F. F. The boxwood leaf-miner. U. S. Dept. Agr. Forest Entomology Brief 68. 1930.

emerging. Undoubtedly many had come out the preceding day, as hundreds of the flies were swarming about the bushes on the morning of the fifteenth. The first application of spray material (molasses 1 : 5, "black leaf 40" 1 : 500) was given immediately and with very satisfactory results. Four other applications at about five-day intervals were also made. No leaf injury has been observed and the destructive effect on the insects was very marked, as dead pupae and adults were found in great numbers adhering to the molasses.

The Boxwood Psylla, Psyllia Buxi Linn.

Another insect which has been found infesting particularly the broad-leaved box in The New York Botanical Garden and other localities of the vicinity is the boxwood Psylla. It is a greenish sucking insect which in its feeding causes a cupping of the leaves so that the insect is well protected within (Fig. 1, C). The insect is related to the common plant lice, aphids, and like certain species of this group is covered with a whitish waxy material. The adults appear as early as April and lay their eggs on the new tip growth. Once the young insect begins to feed, the leaf curls up over it so that it is difficult to reach it with a contact spray. It is, therefore, necessary to begin spraying rather early. Only one brood is believed to develop each season. Good results have been reported[4] with the molasses and nicotine sulfate spray used for the leaf-miner, but since the Psylla may appear earlier than the miner, one or two applications preceding the appearance of the miners would be necessary. As this insecticide is not injurious to the box, this treatment could be only beneficial. If molasses is not at hand, nicotine sulfate, 1 : 500, with the addition of three or four pounds of soap per 50 gallons is recommended, to be applied as soon as the curling leaves are observed.[4]

Scale, Lepidosaphes Ulmi Linn.

The oyster-shell scale has been observed on box at The New York Botanical Garden, but, except for two bushes, in negligible numbers. A parasite on the insects examined, identified provisionally as *Aspidiotiphagus citrinus,* may be effecting control.

[4] Hamilton, C. C. Insect pests of boxwood. N. J. Agr. Exp. Sta. Circ. **179**: 3–14. 1926.

When allowed to develop unharmed, this scale may cause considerable damage. Defoliation and dead twigs encrusted with the insect have been reported. The pest is inconspicuous unless present in large numbers, but may be recognized by its dark-brown or gray shell-like covering about one eighth of an inch long. Its eggs hatch in early spring and spray must be applied before the protecting scale is formed. It is doubtful whether sufficient experimentation has been done to determine whether dormant lime-sulfur, 1:9, would not cause injury. Wilson,[5] however, recommends this proportion, or "Wilson Scale-O," 1:15 or :20. Two applications ten days apart are suggested, to be made just as the new growth starts late in May or June. A second brood may appear in August, at which time a second spray should be given.

Fungi

Leaf spot and canker involving defoliation and death of branches are complained of by growers. The cause of these symptoms is somewhat ambiguous. Two fungi are quite constantly associated with the leaf spot, namely, *Macrophoma Candollei* and *Volutella Buxi,* and one or both probably account for the canker. These two fungi have been observed by the pathologist during the past two seasons.

Material brought from Pleasantville, N. Y., from the estate of Sanford D. Stockton, Jr., in May, 1930, showed dead and dying terminal leaves sharply in contrast with the rich-green lower ones. Evidences of leaf-miner work on a few old leaves were present, but the leaves of last year gave no indication of having been harmed by the insect. Similar specimens were received from Madison, New Jersey. In both cases the main trouble seemed to lie with the fungus, *Volutella Buxi,* whose pale rose-colored spore-masses abounded along the petioles and midribs of the yellowed leaves. When placed in a damp chamber these spore-masses increased, extending over the entire leaf blade. Microscopic examination showed the somewhat waxy spore-clumps to be interspersed with the typical hyaline, blunt, septate hairs (Fig. 2, e). Closely associated with the *Volutella* was *"Verticillium Buxi"* (Fig. 2, a, b, c). The sexual stage of *Volutella Buxi* has

[5] Wilson, Andrew. Insects and their control, 75–79. Thatcher-Anderson Co. New Brunswick, N. J. 1929.

been assumed, on the basis of association, to be *Nectriella Rousseliana.* The constant association of *Verticillium Buxi* with the *Volutella* has led pathologists to believe that they are also connected, so that, if this were true, the fungus would have three stages in its life history. That the *Volutella* and *Verticillium* are the same fungus has been proved by the writers by culture experiments in which fifteen or more single spore isolations were made from each stage. The cultures were indistinguishable in appearance, and in every case both *Volutella* and *Verticillium* developed. In FIGURE 2, a to e represent various stages in the development of

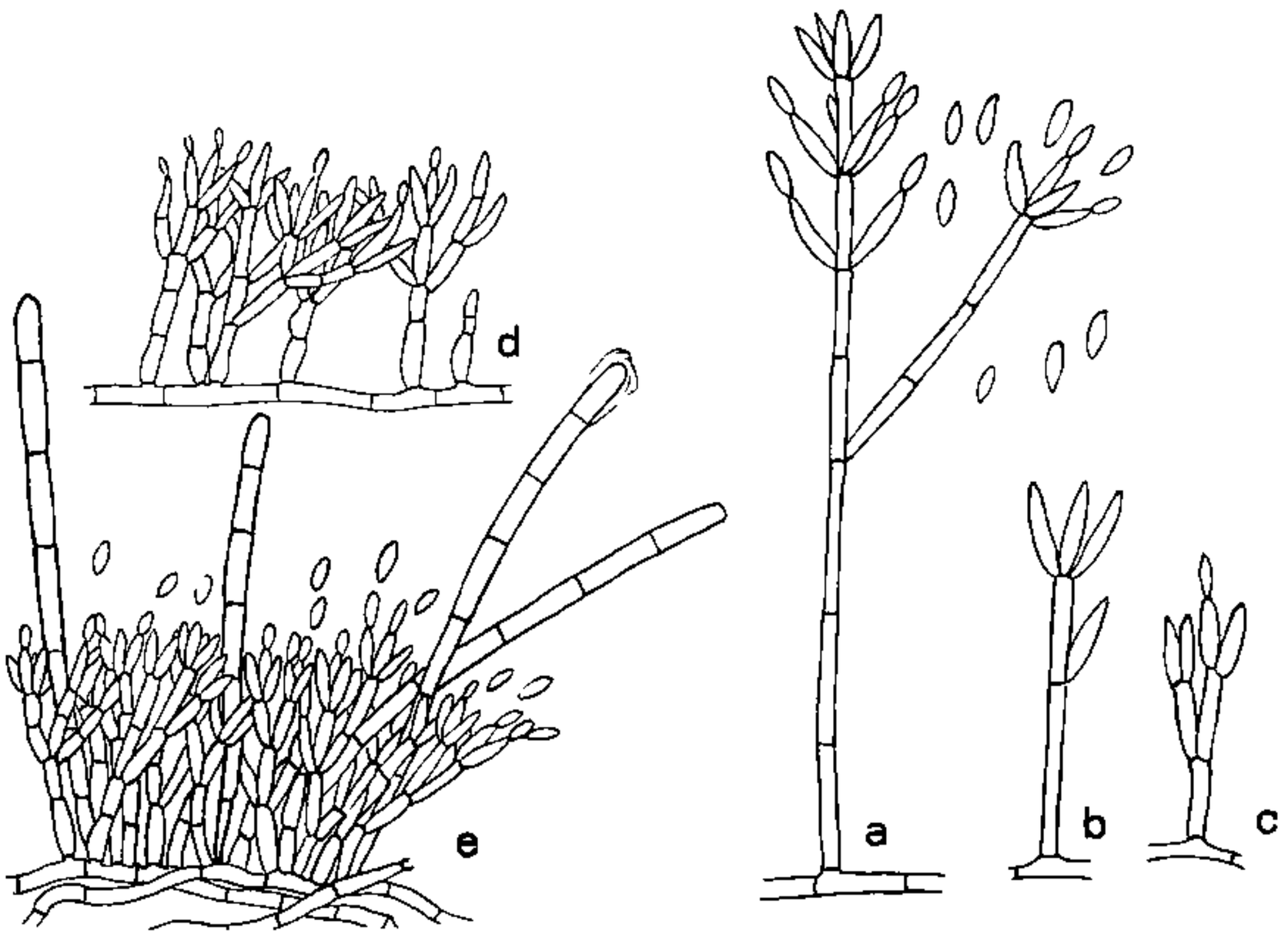

FIGURE 2. *Volutella Buxi.* a-c, Verticillium stages; d, young acervulus; e, mature acervulus with hairs.

the asexual fruiting structures which may be found in the individual single spore-cultures. FIGURE 2, a, represents a typical *Verticillium* conidiophore with its spores. In FIGURE 2, b and c are isolated sporophores which, if crowded together as shown in FIGURE 2, d and e, would be considered acervuli of *Volutella Buxi.*

Macrophoma Candollei leaf-spot has occurred both at The New York Botanical Garden and in the northern suburbs of the city. The specimens observed showed a dead margin about the

leaf tip, noticeably thinner than the rest of the leaf and definitely differentiated from it. This dead margin was dotted with the black pycnidia of the fungus.

Pathologists at the New Jersey Agricultural Experiment Station[6] have also observed a canker associated with the previously described leaf-spot fungi. Dead and dying twigs upon examination showed loose blackened bark, the discoloration often extending into the heart wood. The point of infection is believed to be old branch stubs or injuries invariably found in the neighborhood of the infected region. The causal organism probably hibernates in old diseased leaves which lodge in the moist center of the thick bushes where conditions are ideal for its development. Suggestions[6] for control for these troubles are:

(1) Each spring clean out all old leaves from the center of the clumps and burn; prune out dead branches and paint with a good wound dressing.

(2) Spray with Bordeaux mixture (4–4–50) just before growth starts in the spring.

(3) If a canker has extended completely about the main trunk, surgery will not save it and the whole bush should be destroyed before it infects its neighbors.

B. O. Dodge,
Marjorie E. Swift.

PLANT NUTRITION[1]

All life of this earth depends for its nourishment on the food produced by plants, so in this sense plant nutrition is a very important topic. If we were to give a fraction as much attention to feeding our plants, both in the garden and in the house, as we give to our own food, we would easily have twice as good results with them as we have now. The proper feeding of plants is a surprisingly simple operation. Plants are growing things like young children and like children they are constantly hungry except when they are asleep but the main sleep of plants is not every night.

[6] Box canker. N. J. Agr. Exp. Sta. Nursery Disease Notes, Vol. 1, No. 12. June, 1929.

[1] Abstract of demonstration and talk given at Conservatory Range 2, The New York Botanical Garden, on Saturday, December 7, 1929.

It is a resting period of weeks or months. Likewise, just as we can give children too much concentrated food in candy, cakes, and sweets, so we can easily overfeed our plants if we use concentrated chemical fertilizers and give them as much of these as we would of the older types of manures. Most of the older kinds of fertilizers, such as manure, bone meal, and dried blood, contain rather small amounts of the fertilizer elements. In supplying plants with what they need we must give serious consideration to only three chemical elements:

1. Nitrogen, which is familiar to all of us in household ammonia, in the medicine, potassium nitrate or sweet niter; or in gun powder, the explosive part of which is a nitrogen compound. Nitrogen is the basis for all living protoplasm.

2. Phosphorus, which is most familiar as the striking end of a match and likewise commonly used as medicines in phosphates. Phosphorus is an essential constituent of the bones.

3. Potassium, which gets its name from potash or lye, which was formerly extracted from wood ashes for making soft soap.

These three elements are needed in such large amounts by plants that they have come to be considered the only important ones in fertilizers. The laws of most states now require that all fertilizers that are sold shall have their analysis in these three items stated on the packages. It is customary to give a percentage of each of these in the order I have named them, the nitrogen being stated as a percentage of ammonia, the phosphorus as a percentage of phosphoric acid or phosphorus pentoxide, and the potassium as potash, potassium oxide. The average chemical fertilizer contains about four to six percent of ammonia, ten to twelve percent of phosphoric acid and four to eight percent of potash. This material may be used at the rate of one ton to the acre or one pound to the thousand square feet. This is a moderate application, such as farmers use. On the average garden three to five times this much may be satisfactorily employed; that is, a pound to possibly two hundred square feet. For pot plants, a level teaspoonful to a six-inch pot, either mixed with the soil or stirred in around the plant not closer than an inch away from its stem is a good liberal application. There are a number of more concentrated special fertilizers now available. One of these, Ni-

trophoska, contains fifteen percent of ammonia, thirty percent phosphoric acid, and fifteen percent potash, thus having a formula 15–30–15. This is not only three times as strong as the average fertilizer but also practically all of it is immediately soluble and available. Accordingly it must be used with caution, in small quantities.

Fertilizers vary widely in their availability. Some, such as nitrate of soda, superphosphate, and sulphate of potash, produce immediate effects. Others, like the organic manures, dried blood, bone meal, and wood ashes, are more slowly available and their effects upon the plants continue for a long time. Nitrogen and ammonia help to make the plants grow rapidly and make abundant dark-green foliage. Phosphorus, on the other hand, stimulates flower and seed production. Potash facilitates the storage of food and has a tendency to make plants stiffer and stronger. High nitrogen fertilizers are most of the organic manures, nitrate of soda, or Chile salt-peter, and sulphate of ammonia. High phosphorous fertilizers are phosphates such as superphosphate, bone meal, tankage, basic slag, and ammophos. High potash fertilizers come principally from the German and French potash mines in the form of sulphate of potash or muriate of potash, each of which contains about fifty percent of potash. Wood ashes are likewise a good source of potash but usually contain only ten or fifteen percent.

Next to the fertilizers the most important thing is the acidity of the soil. If the soil is too acid it poisons plants by releasing alum from the clay in soil. Clay is made up of aluminum, with which we are all familiar in kitchenware. Aluminum is a very useful thing so long as it stays in clay or in the metallic form, but when it dissolves with acid as aluminum salts, it is a dangerous poison to both plants and animals. In the soil its effects can be counteracted by adding lime or phosphates. Lime is most commonly used, but it is quite possible to use too much of it. If we lime the soil until it is too sweet, then we get into another difficulty, because the sweet soil not only ties up the harmful aluminum but also the very small amounts of iron and manganese which are necessary to plants. By properly manipulating the acidity of the soil it is possible to do some surprising things. For instance,

some of our best grasses for our lawns thrive in an acid soil. The bent grasses can stand a very acid condition in which weeds cannot grow at all. Even blue-grass will stand more acidity than most weeds. Some fertilizers, like ammonium sulphate, make the soil acid at the same time that they feed the plants. By using only acid fertilizers, such as ammonium sulphate, superphosphate and muriate of potash, we can feed the grass well and at the same time pickle the soil, making it so acid that weeds cannot grow. On the other hand, some of our garden vegetables and plants, such as beets, lettuce, and spinach, roses and Japanese cherries, like a sweet soil and accordingly are benefited by fertilizers which sweeten it, such as nitrate of soda, bone meal, lime and stable manures. Thus far I have discussed only the chemicals that plants get from the soil. The most important food materials for plants come from the air and water. Water constitutes more than nine tenths of most plants and carbon oxide absorbed from the air enters into more than ninety-five percent of the remaining dry tissue. So in nourishing our plants, particularly indoors, we must always remember that the supply of air rich in carbon oxide breathed from our lungs and the supply of water are two essentials. Furthermore the plants need air around their roots as well as around their leaves and accordingly we must be careful to use loose soil through which the air can pass readily and watch the watering, so that the soil can become partly dry and aerated between one watering and the next.

FORMAN T. MCLEAN.

THE PHILIPPINE ISLANDS[1]

Few people realize perhaps the extent of the group of islands the United States secured from Spain when Admiral Dewey defeated the Spanish fleet during the Spanish War. The Philippines form a considerable part of the Malaysian Archipelago and lie wholly within the tropics. The Malaysian Archipelago, if drawn to scale and superimposed on the map of North America with the north end of Sumatra placed at San Francisco would extend across the North American continent and the islands of New

[1] Abstract of a lecture given at The New York Botanical Garden, Saturday afternoon, July 5, 1930.

Guinea at the extreme east would lie wholly within the Atlantic Ocean. The Philippines alone comprise about 7000 small islands scattered over an area of 570,000 square miles. The greatest length of the archipelago north and south is 1,150 miles, somewhat longer than the state of California. East and west the islands extend 665 miles.

The land area is about equal to that of the New England States and New York combined and accommodates a population of about 11,000,000, nearly one tenth of the population of the whole United States. The islands are essentially mountainous, the maximum altitude being on Mt. Apo and Mt. Pulog, each about 10,000 feet.

The climate is strictly tropical except at high altitudes and the rainfall is very heavy with a record precipitation within a period of twenty-four hours of forty-one inches. In other words, it occasionally rains as much in one day as it frequently does here in a year. The scattered islands, great range in altitude, the variation in the seasonal distribution of rainfall, high temperatures and high humidity have favored the development of a very rich and exuberant flora. There are approximately 14,000 species of plants known from there at the present time, about twice as many as were found in Porto Rico and about 10,000 of these represent flowering plants and ferns. There are between 2,500 and 3,000 species of trees. Orchids are also abundant, with 950 known species and the ferns are even more numerous, with 1,000 species of ferns and fern allies. This tropical flora is thus much richer than those of temperate regions. Great Britain and Ireland with an area slightly larger than the Philippines have a combined flora of approximately 2,000 species of flowers and ferns, and all of North Eastern United States and Canada, south to Virginia and west to the Mississippi River, has but about 4,600.

The Philippine Islands also have some very interesting plants typical of the Himalayas and other Asiatic mountains, some Polynesian plants and some Australian ones as well as the typical Malaysian ones. Recent studies show that the flora is made up of elements from regions as remote as British India and Japan to the west and north and Australia and New Zealand and New Caledonia to the south and east with scattered elements of the remote regions of Polynesia and even from Africa and Madagascar.

The principal alliance of the Philippine flora is chiefly with the Sunda Islands group, that is Borneo, Sumatra and Java. The presence of Papuan, Australian and New Zealand types is explained by previous geologic conditions. The Philippine Islands and the islands immediately to the south of them have been, for a long period of time an unstable group, which has been subject to numerous depressions and elevations. This unstable insular area lies between two stable continental areas to the west and south. The greatest extension of Asia included what is now Sumatra, Java, Borneo, Palawan in the Philippines. To the south-east the former Papuan-Australian continent has also contributed to the Philippine flora. The migrations of plants and animals have been mainly in the northern and southern direction over this island area rather than east and west across it. The Philippines, Borneo and the Celebes, are separated from Asia by the depression along Wallace's line, and from the southern continent by Weber's line, lying north of Australia and New Guinea. The fauna and flora of the Philippines and the islands to the south, Celebes, and the Lesser Sunda Islands, is made up largely of elements from the two continental areas above mentioned. The Philippines are thus a meeting place for plants from widely scattered tropical regions.

E. D. MERRILL.

NOTES, NEWS, AND COMMENT

Professor F. H. Kramer, of Gettysburg College, Gettysburg, Pa., has recently presented to the Garden a large Christmas Cactus, *Zygocactus truncatus*, which has been in his family for nearly fifty years. After a certain amount of subdivision, it has been installed in one of the cactus houses of Conservatory Range No. 1.

Dr. E. D. Merrill, Director-in-Chief, left New York on July 19 to attend the Fifth International Botanical Congress, to be held in Cambridge, England, August 16–20, and to visit botanical institutions in Great Britain and on the Continent. Dr. A. B. Stout, Director of the Laboratories, sailed on June 28, with similar purposes in view, and Dr. J. H. Barnhart, Bibliographer, and Dr. B. O. Dodge, Plant Pathologist, followed on August 2. Dr. H. A. Gleason, Curator, who also will attend the Congress, left on April 19, on a five months' leave of absence.

The Upper Cretaceous Floras of Alaska, by Dr. Arthur Hollick, Paleobotanist of The New York Botanical Garden, has just been issued as Professional Paper 159 of the United States Geological Survey. It is a quarto publication of 123 pages, with 87 plates and 5 text figures. A geological description of the plant-bearing beds and associated rocks, by Dr. George C. Martin, precedes the descriptions of the fossil plants by Doctor Hollick, which include 1 alga, 1 hepatic, 13 pteridophytes, 47 gymnosperms, 2 monocotyledones, and 173 dicotyledones. Dr. Hollick was in Alaska in 1903 and made a reconnaissance trip by canoe down the Yukon River, in connection with the work of the United States Geological Survey. The specimens collected during this trip form the basis of the present work, with additions based upon material collected by field parties of the Survey in subsequent years. Many new species and several new genera are described. Cycads and ginkgos, represented by numerous species; several species of *Sequoia* and *Glyptostrobus, Taxodium* and *Tumion,* with several extinct forms of other gymnosperms make up a large part of the flora; and among the angiosperms the Nymphaeaceae and the Platanaceae, including many new genera, appear to be among the most prominent elements. An analysis of the generic elements of the floras leads the author to conclude that "it may be seen that the flora as a whole was warm-temperate in its major facies, with a conspicuous representation of subtropical and tropical elements." In the "Foreword" it is stated that a similar volume on the Tertiary flora of Alaska is in course of preparation by the same author.

Meteorology for July. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 87° F. on the 2nd; 91° on the 7th; 100° on the 20th; and *103° on the 21st.* The minimum temperatures recorded were: 60° on the 4th; 61° on the 12th and 13th; *56° on the 15th;* and 66° on the 25th. The total precipitation for the month was 2.61 inches.

ACCESSIONS

LIBRARY ACCESSIONS, NOVEMBER 1–DECEMBER 31, 1929 (CONTINUED)

VELENOVSKÝ, JOSEF. *Die Flora der böhmischen Kreideformation.* Parts 1–5. Wien, 1882–85.

WARMING, JOHANNES EUGENIUS BÜLOW. *Om planterigets Livsformer.* Kjøbenhavn, 1908.

WEHMER, CARL. *Die Pflanzenstoffe.* Ed. 2. Vol. 1. Jena, 1929.

WESENBERG-LUND, CARL JØRGEN. *Studier over de danske Søers Plankton.* Specielle Del. 1. Tekst; 2 Bilag. Kjøbenhavn, 1904.

ZACHARIAS, EMIL OTTO. *Die Tier- und Pflanzenwelt des Süsswassers.* 2 vols. Leipzig, 1891.

ZEILLER, CHARLES RENÉ. *Description de la flore fossile [du bassin houiller de Valenciennes].* 2 vols. Texte and atlas. Paris, 1886–88.

MUSEUMS AND HERBARIUM

2 specimens of algae from Costa Rica. (By exchange with the United States National Museum.)

32 specimens of North American Hepaticae. (Given by Miss Caroline C. Haynes.)

27 specimens of Hepaticae from Honduras, Guatemala, Venezuela, Hawaii, Japan, and New Zealand. (Given by Dr. George H. Conklin.)

12 specimens of marine algae from Brazil, Trinidad, etc. (By exchange with Prof. William Randolph Taylor.)

2 specimens of *Botrydium* and *Protosiphon* from Maine. (Given by Mr. John C. Parlin.)

218 specimens of Pteridophyta from Jamaica, B. W. I. (Given by Mrs. Wm. R. Pitt.)

397 specimens of miscellaneous marine algae. (Given by Mrs. Wm. R. Pitt.)

3 specimens of *Gelidium crinale* from Haiti. (Given by Prof. W. R. Taylor.)

1 specimen of *Pellia Neesiana* (bivalent, hermaphrodite form). (Given by Dr. A. M. Showalter.)

27 specimens of North American Anthocerotaceae. (Given by Miss Caroline C. Haynes.)

2 specimens of *Riccia* from California. (By exchange with Yale University.)

12 specimens of Lithothamnieae from California. (By exchange with the University of California.)

12 specimens of marine algae from California. (Given by the Field Museum.)

23 specimens of marine algae from Panama. (By exchange with the Farlow Herbarium, Harvard University.)

1 specimen of *Chara foliolosa* from Texas. (By exchange with the United States National Museum.)

100 specimens of fungi, algae, lichens, hepatics, and mosses (Century 31 of "Kryptogamae Exsiccatae"). (Deposited by Columbia University.)

2 specimens of marine algae from the Philippine Islands. (By exchange with the United States National Museum.)

3 specimens of marine algae from Cape Breton Island. (Given by Miss Muriel V. Roscoe.)

1 specimen of *Enteromorpha intestinalis* from Nebraska. (By exchange with the United States National Museum.)

4 specimens of cryptogams from Peru. (By exchange with the United States National Museum.)

29 specimens of algae from Uruguay. (Given by Dr. F. Felippone.)

1 specimen of *Gelidium crinale* from Texas. (By exchange with the United States National Museum.)

1 specimen of *Riccia Sullivantii* from New Jersey. (Given by Prof. R. A. Harper.)

3 specimens of *Riccia* from Oklahoma and Montana. (Given by Mr. A. J. Sharp.)

5 specimens of *Inactis* and other calciferous algae from West Virginia. (Given by Dr. David White.)

12 specimens of marine algae from Cuba. (Given by Dr. Mario Sanchez Roig.)

14 specimens of marine algae from Costa Rica. (By exchange with the United States National Museum.)

26 specimens of marine algae from British Honduras. (Given by Mr. C. L. Lundell.)

9 specimens of marine algae from Haiti. (Given by Prof. Wm. R. Taylor.)

1 specimen of *Anthoceros punctatus* from Santo Domingo. (Given by Dr. R. Ciferri.)

2 specimens of marine algae from Bermuda. (Given by Dr. & Mrs. L. R. Blinks.)

1012 specimens of marine algae, mostly from the Pacific Coast of North America. (By exchange with the University of California.)

75 specimens of marine algae from Martinique. (Given by M. Gontran Hamel.)

8 specimens of marine algae from La Jolla, California. (Given by Prof. Wesley R. Coe.)

16 specimens of marine algae from California. (Given by Mrs Nina Loomis.)

3 specimens of freshwater algae from Costa Rica. (By exchange with the United States National Museum.)

4 specimens and 2 ground sections of fossil (Ordovician) algae (*Dimorphosiphon rectangulare* and *Chaetocladus capillatus*) from Norway. (By exchange with the Paleontologisk Museum, Oslo, Norway.)

58 specimens of marine algae from Canary Islands. (By exchange with Dr. F. Børgesen.)

11 specimens of *Riccia Austini* from Texas. (Given by Miss Caroline C. Haynes.)

2 specimens of *Cephaloziella Haynesiae* from South Carolina. (Given by Miss Caroline C. Haynes.)

44 specimens of fungi from Maine. (Collected by Mr. Percy Wilson.)

29 specimens of "Fungi Dakotenses," Fascicle 27. (Distributed by Dr. J. F. Brenckle.)

1 specimen of *Pseudobalsamia microspora* from Minnesota. (By exchange with the U. S. Dept. of Agric.)

3 specimens of cup-fungi from California, Oregon, and Washington. (By exchange with Dr. Gertrude S. Burlingham.)

1 specimen of *Patella erinacea* from Nebraska. (By exchange with Miss Catharine Lieneman.)

1 specimen of *Peziza domiciliana* from Utah. (By exchange with Prof. A. O. Garrett.)

1 specimen of *Dasyscypha arida* from Canada. (By exchange with Prof. H. S. Jackson.)

1 specimen of *Sclerotinia fructicola* from Virginia. (By exchange with Mr. W. W. Diehl.)

2 specimens of fungi from Maryland. (By exchange with Prof. Charles S. Parker.)

2 specimens of fungi from Pennsylvania. (By exchange with Dr. L. O. Overholts.)

ADDITIONS TO THE COLLECTIONS OF DAHLIAS (1930)

48 plants, 3 varieties; and 11 roots, 6 varieties. (Given by Mrs. Charles H. Stout.)

33 plants, 27 varieties. (By exchange with Serg. Michael A. Batto.)

32 roots, 16 varieties. (Given by Dahliadel Nurseries.)

30 roots, 15 varieties; and 14 plants, 7 varieties. (Given by Peacock Dahlia Farms, Inc.)

26 roots, 15 varieties; and 12 plants, 4 varieties. (Given by Success Dahlia Gardens.)

24 plants, 12 varieties. (Given by Mr. Charles H. Totty.)

23 plants, 15 varieties. (Given by Dr. M. A. Howe.)

21 plants, 8 varieties. (Given by Chemar Dahlia Gardens.)

13 plants, 8 varieties; and 6 roots, 3 varieties. (Given by Mr. C. Louis Alling.)

13 roots, 12 varieties. (By exchange with Mrs. Carl Sherwin.)

12 plants, 6 varieties; and 12 roots, 6 varieties. (Given by Fisher & Masson.)

12 plants, 4 varieties. (Given by W. E. Marshall & Co., Inc.)

10 roots, 8 varieties. (By exchange with Mr. Albert Parrella.)

9 roots, 4 varieties. (Given by Mr. Harbeck Mills, Jr.)

8 plants, 8 varieties. (Given by Waite's Gardens, Inc.)
8 roots, 8 varieties. (Given by Mr. J J. Broomall for Success Dahlia Gardens.)
7 roots, 7 varieties. (By exchange with Mr. Herbert D. Green.)
7 roots, 3 varieties. (By exchange with Mr. Leo Ritter.)
7 roots, 1 variety. (Given by Mr. F. S. Cackener.)
6 plants, 3 varieties. (Given by Lyndora Gardens.)
6 roots, 3 varieties. (Given by Ballay Dahlia Garden.)
6 roots, 3 varieties. (Given by Blue Ribbon Dahlia Co.)
6 roots, unnamed varieties. (By exchange with Mrs. M. A. Green.)
5 roots, 5 varieties; and 3 unnamed varieties. (Given by Mr. J. Hood Branson.)
5 roots, 4 varieties. (Given by Mr. Curtis M. Redfern.)
4 plants, 3 varieties. (Given by Mr. Frederick E. Dixon.)
4 plants, 2 varieties. (Given by Prof. George W. Fraser.)
4 roots, 2 varieties. (Given by Blue Ribbon Gardens.)
4 roots, 2 varieties. (Given by Mr. Nathan A. Miller.)
4 roots, 2 varieties. (By exchange with Mr. George Schwacha.)
3 clumps, 1 variety. (By exchange with Mrs. A. E. Rogers.)
3 plants, 1 variety. (Given by Mr. J. McCarroll.)
3 plants, 1 variety. (Given by Mr. Joseph Nuneviller.)
3 roots, 1 variety. (Given by Mr. John Brandum.)
3 roots, 1 variety. (Given by Mr. M. S. Lewis.)
2 clumps, 2 varieties. (By exchange with Mrs. Elizabeth Pincula.)
2 plants, 1 variety. (Given by Alice Meussdorffer Dahlia Gardens.)
2 plants, 1 variety. (Given by Mr. H. R. Chapman.)
2 plants, 1 variety. (Given by Golden Rule Dahlia Farm.)
2 roots, 2 varieties. (By exchange with Dr. J. Hahn.)
2 roots, 1 variety. (Given by Mr. W. Evans Smith.)
1 clump of roots, 1 variety. (Given by Miss Delia Marble.)

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THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York, N. Y.

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Some of the leading features of The New York Botanical Garden are:

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THE NEW YORK BOTANICAL GARDEN
BRONX PARK, NEW YORK, N. Y.

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E. D. MERRILL

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THE IMPROBABILITY OF PRE-COLUMBIAN EURASIAN-AMERICAN CONTACTS IN THE LIGHT OF THE ORIGIN AND DISTRIBUTION OF CULTIVATED PLANTS

In his classical volume on the origin of cultivated plants A. de Candolle makes the following significant closing statement: "In the history of cultivated plants I have noticed no traces of communication between the peoples of the old and the new worlds before the discovery of America by Columbus." In other words he definitely shows, but does not stress the fact because it is so very obvious, that pre-Columbian agriculture in America was based wholly on strictly American species, and that previous to the voyages of Columbus there was not a single basic food plant common to the two hemispheres. The same statement is true in relation to domesticated animals, the dog being the only one that was common to Eurasia and America in pre-Columbian times.

Most popular writers on ethnological subjects and some ethnologists who have theorized regarding the supposed Eurasian influences on early American civilizations have curiously overlooked this most important contribution to the subject from the realms of botany and zoology. There are those who maintain that the ancient civilizations of Peru, Central America, and Mexico were derived from Mediterranean sources and that the ancient Egyptian civilization somehow influenced the development of civilization in America. Some claim that these early Egyptian influences extended to America by way of Polynesia, and others explain the similarities by the assumption of an ancient Atlantean continent or island situated somewhere in the Atlantic Ocean between the

Mediterranean basin and America; and some proponents of the Atlantis theory go so far as to claim and attempt to prove that both the Mediterranean civilization in Europe and the ancient civilizations in America were derived from this hypothetical Atlantis. To the vigorous proponents of the Atlantis theory I merely query, what could have been the agriculture of this hypothetical Atlantis that transmitted to its supposed descendants in the two hemispheres not a single food plant and not a single domesticated food-producing animal in common?

As one reads technical and popular papers supporting these theories, one may be impressed by the array of facts that are presented, and sometimes one is almost convinced that the theorist must be correct in his deductions, the supporting evidence being so plausibly presented—until one realizes that the data represent only an affirmative argument, the negative side being usually conspicuous by its absence. At this stage of realization he will probably cast his lot with a third group that maintains that man reached America as a very primitive savage and that all pre-Columbian civilizations in America developed here independently of all direct or indirect European or Asiatic influences; in other words, that the early American civilizations were strictly autochthonous. Let us see what bearing the origin of cultivated food plants has on this problem.

It is clear that all cultivated plants and all domesticated animals have been derived at some time in the development of the race, and for the most part early, from wild forms. Every basic food plant was already in cultivation at the dawn of recorded history, and most or all of our domesticated animals have the same record. It is manifest that agriculture as an art must have been developed and practiced for a very long period of time before man developed any considerable degree of civilization; agriculture, ensuring a stable and dependable food supply, is the basis of all higher civilization, and its development must have preceded the attainment of any permanent higher culture.

The basic food plants of American origin include but one cereal, but this a very important one, maize or Indian corn. The other important strictly American items are the potato, sweet potato, lima bean, all of our common garden and field beans, the tomato,

pepper, Jerusalem artichoke, squash, pumpkin, peanut, and in the more strictly tropical regions cassava, or tapioca, arrowroot, chayote, and such fruits as the papaya, avocado, pineapple, custard apple, soursop, cherimoya, sapote, sapodilla, cacao or chocolate, cashew, and others. None of these were known in Europe or Asia until after Columbus' first voyage in 1492.

The basic food plants of Eurasia are the common cereals, wheat, rye, barley, oats, rice, and others of minor importance, such as millet, Italian millet, pearl millet, sorghum, ragi, teff, coix, etc., and for convenience buckwheat may also be classified here, although it is not a true cereal. To this list should be added most of our common garden vegetables such as the turnip, cabbage, radish, beet, parsnip, carrot, onion, spinach, lettuce, celery, asparagus, pea, and many others; practically all of the fruits characteristic of the North Temperate Zone, including the pear, plum, cherry, apple, apricot, peach, prune, olive, fig, almond, European grape, and the melons; and such tropical products as the banana, coconut, orange, lemon, lime, date, mango, bread-fruit, and many others. All domesticated animals except the turkey, the llama, and alpaca are also of Eurasian origin. None of the plants above listed or domesticated food-producing animals other than the three mentioned above were known in America before 1492.

It is important to realize that primitive man had selected and domesticated all of our basic food plants and food-producing animals long before the dawn of recorded history. If there had been pre-Columbian contacts between Eurasia and America after agriculture was established, as many theorists insist, the more important of the basic food plants and domesticated animals of both hemispheres would have been generally dispersed and not limited to the continental areas of the two hemispheres as was the case up to very recent times, *i. e.*, the close of the 15th century; for not a single basic food plant or a single food-producing animal in domestication was then common to both hemispheres. The theorist who would derive the pre-Columbian American architecture, sculpture, art, and hieroglyphic writing, as well as the social, political, and ecclesiastic organizations from Eurasian sources overlooks the manifest fact that the first thing man does when he contacts with a new region, is to take with him those items that are

basic to a permanent food supply; that is, his cultivated plants and domesticated animals. This was just as true 10,000 years ago as it was at the time of the European colonization of America in the sixteenth and seventeenth centuries.

It is an evident fact that the domestication of plants and animals took place independently in various parts of Eurasia and in America; that agriculture was developed in the two hemispheres independently of each other's contributions in plants, in animals, and in methods; and that concurrently civilizations based on agriculture developed in Eurasia and in America independently, the one being totally uninfluenced by the other.

It would seem that the popular writer on ethnological subjects, such as possible early Eurasian-American contacts, as well as professional, amateur, and near-ethnologists, should examine the data from the standpoint of the phytogeography of cultivated plants and the zoögeography of domesticated animals before reaching conclusions that from a biological standpoint are absolutely untenable. After all, we take our cultivated plants and domesticated animals for granted and seldom give a thought as to whence they came, when and where they were adapted to the needs of man, how, when, and by whom they were disseminated, and whether or not major distribution took place in pre-historic or modern times. To him who theorizes on pre-Columbian Eurasian-American contacts it is a subject worthy of the most critical consideration, and one that can not safely be ignored. The biological-agricultural evidence is wholly and unmistakably in support of an autochthonous development of pre-Columbian civilizations in America, with absolutely no Eurasian contacts and no Eurasian influences shaping or developing them.

E. D. Merrill.

GLADIOLUS EXHIBITION AT THE NEW YORK BOTANICAL GARDEN

On Saturday and Sunday, August 23rd and 24th, the Second Annual Exhibition of the Metropolitan Gladiolus Society was staged on the main floor of the Museum Building at The New York Botanical Garden. This show was also the eastern regional exhibition of the American Gladiolus Society, the Metropolitan Gladiolus Society being affiliated with the national society. The quality of gladiolus blooms shown this year was superb, and has scarcely been excelled in any previous showing here. A heavy, beating rain-storm on the opening day kept many exhibitors away, and the previous unbroken drouth of weeks' duration prevented any exhibits from the central part of New Jersey, but the quality of blooms shown fully made up for any deficiency in numbers. Since about three hundred varieties were represented in the show room and fully twice as many kinds were in bloom in the display grounds, of the thousand varieties grown there, there was ample variety of forms and colors for the visitors to see.

Noteworthy exhibits were set up by Mrs. Courtlandt D. Barnes, of Manhasset, Long Island, who won the Stumpp and Walter silver cup a second time for the sweepstakes prize in the amateur classes, the Max Schling Silver and Bronze Medals, and the American Gladiolus Society Silver Medal in the open classes; Mr. Alfred J. Kroll, of Round Hill, Greenwich, Connecticut, who won two American Gladiolus Society Bronze Medals for the longest flower head and largest gladiolus flower, and the American Gladiolus Society Gold and Bronze Medals for the finest exhibit in the open classes; Mr. Neil F. MacDonald, who was second only to Mrs. Barnes in the sweepstakes; Mr. A. J. Walsh, of Yonkers, N. Y., a novice in exhibiting, who won the British Gladiolus Society Silver Medal for the best ornamental arrangement of Gladiolus flowers; Mr. Julius Gerlich, of Somerville, New Jersey, who won the British Gladiolus Society Bronze Medal for the finest exhibit of newer varieties; Mr. Frederick W. Cassebeer, of New York, whose outstanding displays of new varieties of the dainty little primulinus race won many awards and aroused much favorable comment; and Mr. Robert F. Miller, another novice exhibitor, who brought his blooms all of the way from Scranton,

Pennsylvania. His blooms made a fine showing and won several prizes after their journey through three states. The Gladiolus is one of the best flowers for long-distance shipping, and one of our finest exhibits last year came from Vermont.

Fully three hundred varieties were in the show, and many of them were represented by blooms of the very highest quality, with cut stalks four to five feet long and heavy heads of blooms, each flower five to six inches across. The largest bloom was of the variety Mrs. Leon Douglas, grown by Mr. Alfred J. Kroll and measuring nearly six and a half inches across. It thus equaled the largest bloom in the Nylic Garden Club show the previous week in the New York Life Insurance Building downtown, where Mr. Charles A. Robinson showed a spike of the same variety sixty-two inches tall, with five blooms open, the lowest six and a half inches across.

Another remarkable specimen was one of the variety Mrs. F. C. Hornberger grown by Mr. Harry F. Page, of Cranford, New Jersey, and winning the Vaughan Bronze Medal for the best spike of a white gladiolus in the show. A stalk fully four feet long, six fine blooms open and many buds showing color, made this an outstanding flower spike, even for this truly handsome pure white variety originated here in New York State.

The three finest spikes exhibited in the open classes were of the variety Mrs. Leon Douglas, grown by Mr. Kroll, and their supremacy was closely contested by several others. Mrs. Barnes grew the winning spikes in the yellow class—three tall handsome stalks of the English variety, Golden Measure, which won over the deeper-colored and taller Canadian Golden Dream, though Golden Dream easily surpassed it in the class for the longest flowerhead, and that award was again closely contested by a spike of an American variety from New England, Miss T. Rose, a creamy flesh-colored variety grown by Mr. Sherrard Ewing, of Bronxville. The flower head of the latter was only a quarter of an inch shorter than that of Mr. Kroll's spike of Golden Dream—truly a close margin by which to decide an international question of varietal merit! Among the reds, the German variety, Pfitzer's Triumph, exhibited by Mrs. Barnes, easily and consistently won, as did her stalks of the lavender variety Captain Boynton, an-

FIGURE 1. A part of the 1930 Gladiolus Exhibition at The New York Botanical Garden.

other native of New York State. Mr. Ewing and Mr. Walsh, both novices in gladiolus exhibiting, won several awards with their well-grown spikes of Miss T. Rose, white Mrs. F. C. Hornberger, pink Longfellow, purple Charles Dickens, lavender Mrs. F. C. Peters, and striped red-and-cream Carnival. These same varieties, with the large-flowered Emile Auburn, Purple Glory, orange Nancy Hanks, cream Fern Kyle and pink Giant Nymph, and the primulinus varieties orange Ethelyn, purple E. B. Williamson, white Tiffany, lavender-pink Gladness and red Scarlet Bedder were heavy winners in many classes. The Gladiolus is the ideal flower for the novice and amateur, being easy to grow and to grow well, and yielding a maximum of cut flowers for a minimum of time expended on care and culture.

Interesting and instructive displays were staged by the Firthcliffe Gardens, of Pearl River, N. Y., winners of the British Gladiolus Society's Silver Gilt Medal for the best display; by the Marilyn Gardens of Hicksville, Long Island; and by Vaughan's Seed Store of New York and Chicago, who claim to be the largest growers of gladiolus in the United States. Vaughan's exhibited twenty varieties of their own origination, grown for them at the Botanical Garden from bulbs furnished for that purpose. The high lights in this exhibit were Edith Mason, a lovely large pure pink; Tawny, a tawny orange well described by its name; and Bijou, an orange-tinted creamy-yellow primulinus grandiflorus with ruffled edges. The Firthcliffe Gardens displayed a fine collection of the newer varieties, such as lavender-pink Berty Snow and smoky Duchess of York, from Mair in Scotland; the Australian white-throated smoky Hinemoa, pink Llewellyn, orange-pink Marnia, salmon Gloriana, and about fifty others, staged in an attractive pyramid in the center of the rotunda. The Marilyn Gardens exhibit was also a colorful and handsome one, including nearly the the entire range of tints in the Gladiolus, from purple-violet Aida and brown-maroon John T. Pirie, dark red Purple Glory and red and blue-slate mottled Bengal tiger, Golden Glory, and Golden Measure, to pink Longfellow, bright-red Pythia, salmon-pink Catherine Coleman, ruffled White Glory, and the new imported purple Franz Hals.

While Mrs. Barnes was competing almost entirely with men in the gladiolus classes, in the ornamental displays and classes for

other garden flowers, the ladies took first place. Both Mrs. Franklin M. Jones and Miss Nellie Kuh, of New Rochelle, took many awards in these classes, and Mrs. Jones won The Gladiolus Book, by McLean, Clark, and Fischer as a sweepstakes prize in the classes for flowers other than gladiolus. Since she is already a convert to the Gladiolus it was a more appropriate award than might at first appear!

With such high quality of flowers and many close decisions, the judges' duties were heavy. The judges were Mrs. Wheeler H. Peckham, of New Rochelle, Professor E. A. Clark of the New Jersey Agricultural Experiment Station, and A. C. McLean, County Agent at Trenton. Mrs. Sarah V. Coombs, of the Scarsdale Garden Club, managed the exhibition entries and awards, with a staff of assistants drawn from The New York Botanical Garden, and the floor management was handled by the Garden staff. The Horticultural Society of New York, through Mrs. Peterson, rendered able assistance, both in material and guidance. The judges and officers were guests of The New York Botanical Garden at an informal luncheon immediately after the judging was completed on Saturday. Large crowds came to see both the indoor and outdoor displays of flowers, particularly on Sunday.

FORMAN T. MCLEAN.

AUSTRALIA, PAST AND PRESENT[1]

AUSTRALIA IN THE PAST

The story of what we know and what we infer in regard to the past or geologic history of Australia will be in the nature of a brief prelude or preface to the descriptions of present-day conditions that will be presented and discussed by Doctor McLean.

If a map of the eastern hemisphere is examined, it may be seen that Australia represents a southeastern extension of the Eurasian continent by way of the Malay peninsula and numerous intermediate islands. It is the smallest of the continental areas, except Greenland, and has an area approximately equal to that of the United States.

[1] Abstract of a joint illustrated lecture given at The New York Botanical Garden on Saturday afternoon, October 26, 1929.

If a map that shows the submarine deeps and contours is examined, it may be noted that a uniform depth of relatively shallow water lies between Australia and New Guinea and Australia and Tasmania. In fact if their coasts were uniformly raised, so that the present 100-fathom contour became the coast line, they would all be included in a single continental land area.

Although relatively small in area and more or less isolated from other centers of civilization, Australia regards itself, politically, as the most progressive commonwealth in the world. The national motto is "Advance Australia." Biologically, however, at least in so far as its native fauna and flora are concerned, it is the most primitive and backward area of land in any part of the world today. The aborigines—the Talgais—are classed as the most primitive of existing human beings; and the rest of the mammalian life, except the wild dog or dingo, and several species of rats, mice, and bats, is exclusively of the primitive marsupial type, represented by kangaroos, wombats, wallabys, etc., and the yet more primitive monotremes, represented by the Duck-billed Platypus and Echidna. Such types of life exist nowhere else in the world today, except for the American opossums; and incidentally it is of interest to note that there are no true opossums in Australia. The flora, also, although not as primitive, relatively, as the fauna, contains many unique elements not found in any existing flora elsewhere.

When the earlier explorers visited Australia—De Gonneville in 1503, Tasman in 1642, Dampier in 1690, and Cook in 1770—they found there, except for the aborigines, the dingo, and the rats, mice, and bats, only the strange outlandish marsupial and monotreme types of animal life, and a vegetation that included many hitherto undescribed species and genera of palms, cycads, and conifers, giant gum trees (Eucalyptus), and other species and genera of angiosperms unknown outside of Australia.

It is a unique fauna and flora, isolated and remarkably distinct from the world at large; and yet, if an intelligent, native-born descendant of one of the early colonists were to be suddenly translated back into Mesozoic time, toward the middle of the Cretaceous Period—at about the time when the Amboy clays were being deposited off our present eastern continental coast line and the Dakota sandstone was being laid down as sand on the shores of

the inland sea that occupied what we now call the middle west of the continent—if we can visualize him thus translated, no matter in what part of the world he might find himself at that time, he would look about him and probably remark "Well, this looks like Australia." Roughly speaking, this would be from three to six millions of years ago, but our hypothetical translated, transplanted Australian, whether he found himself in Europe or somewhere in America, would be surrounded by many of the types of the Australian vegetation with which he was familiar eucalyptus, araucarian pines, etc. —, and he would see no type of mammalian life other than that represented by his friends the marsupials. The fossils contained in deposits of Cretaceous age provide us with the necessary evidence. All of the mammalian remains are those of marsupials—exceedingly small and primitive ones—and the plant remains are largely types such as are now living in Australia. If we were to reconstruct, from these plant remains, an ideal landscape of the Cretaceous period in either Europe or America, it would suggest, very closely, a similar landscape in Australia today.

In other words we may regard Australia in the light of a fossil continent, and a large part of its native wild life as living fossils—types of life that were in existence throughout the world some millions of years ago, but were subsequently exterminated everywhere except in Australia. The question that naturally occurs to any interested person is "how did this happen?" We know that the existing mammalian life of Australia is of the primitive marsupial type, except for the native black man, and the dingo that he probably brought over with him from the mainland; some rats and mice that may have drifted over on logs or rafts or forest débris from river floods and hurricanes; and bats that flew or were blown over. None of the higher or placental type of mammals that were evolved during Tertiary time elsewhere in the world ever inhabited Australia. No tigers, bears, deer, horses, elephants, etc., were ever in existence there. All the fossil mammalian remains in Australia are those of marsupials. Australia must, therefore, have been cut off from the rest of the world when this type of mammal was the dominant and exclusive one, some time during the Cretaceous period, and previous to the

time when the placental mammals supplanted them, in the Tertiary period.

During the Tertiary period all of the continental areas, with the exception of Australia, were linked together. Eurasia and North America were connected where Behring Strait now is. Animals could and did migrate from continent to continent, but not to or from Australia. Many of these reached the Malay peninsula, but they could no more swim over to Australia than the kangaroo or the wombat could swim over to the mainland. Some convulsion of nature must have separated Australia from the rest of the World in pre-Tertiary time, and while the world at large, with its many physiographic and climatic changes, was constantly forced to evolve new types of animal and vegetable life to meet the constantly changing conditions, Australia—isolated, undisturbed by any violent climatic or geologic changes or by competition with any higher forms of life—went quietly on its way and evolved its own peculiar types of life to the best of its ability.

The line of demarkation between the Australasian and the Malaysian or mainland types of life is sharply drawn by a deep arm of the sea that begins South of Mindanao and thence continues through the Celebes Sea, Macassar Strait, Sunda Sea, between the islands of Bali and Lombok, and thence into the Indian Ocean. This is known as Wallace's line, after Alfred Russel Wallace, the naturalist, who first directed attention to the significant facts of biological distribution connected with it. The Celebes, the Moluccas, New Guinea, Australia, and Tasmania lie to the east of it; Borneo, Java, Sumatra, and the Malayan peninsula to the west. Some years ago a book was published in England, entitled "Captain Lawson's adventures in New Guinea," in which were described encounters with lions, leopards, rhinoceroses, etc., none of which exist on that island. If he had located his adventures a few miles to the west, in Borneo, or Java —just across Wallace's line—the hoax might not have been discovered; but of course the first naturalist who read the work exposed the deception.

In conclusion, in case our friends the anti-evolutionists and fundamentalists may feel that their views have been ignored, the

following attempt to present an acceptable interpretation of the facts may not be out of place:

An Arkeological Epic

Father Noah and his sons, they invited to the Ark
A distinguished group of mammals, all placental;
But they snubbed the duck-billed platypus and the jumping kangaroo,
In a manner that was very far from gentle.

To the Talgai boy they hinted he was nothing but a moron,
Whom principles eugenic would condemn;
And they'd better let him perish than continue as a menace
To society, and to Japheth, Ham, and Shem.

So he called to the big Diprotodon, and on its back he climbed,
And he whistled to the friendly dingo, too;
Then the platypus, the wombat, and the rest fell in behind,
As the simple-minded very often do.

They jumped upon an island that kindly floated by,
And they drifted far to southern seas unknown,
Where these brave marsupialia, in a land we call Australia,
Formed a doughty little kingdom of their own.

From here on the thread of the story will be continued by Doctor McLean, who will tell you about the "doughty little kingdom" as it exists today.

The lecture was illustrated by lantern slides that included maps showing the location of Australia in relation to the adjacent mainland and islands, the biological provinces into which the region is divided, the surrounding submarine contours, the location of Wallace's line, etc. Also charts of the world in Tertiary and Cretaceous time, showing former continental land connections and topographic features, distribution of Cretaceous mammalia, etc., and reconstructions of fossil marsupials and plant life.[1]

ARTHUR HOLLICK.

PRESENT-DAY AUSTRALIA

Not only has Australia been isolated from the other continents of the world since early geological times; it was also undisturbed

[1] See ALLEN, GRANT. A fossil continent. Pop. Sci. Monthly, vol. 33, Sept. 1888.

GREGORY, WM. K. Australia, the land of living fossils. Natural History, vol. 24, Jan.-Feb. 1924.

by the Ice Age and other great geological changes. West Australia in particular has been undisturbed dry land since before the Cretaceous period, and seems to have had a mild subtropical climate, which has gradually become drier and drier. The isolation and resulting absence of competition from the higher forms of life which overran the rest of the world, the continuously mild climate, and the gradual drying out of the Australian continent, permitted the primitive plants and animals to persist there and to evolve gradually into drouth-resistant types, instead of being crowded out by the more aggressive modern animals and plants.

The animals have apparently advanced more than the plants during the ages since Australia was cut off from the world. Old orders of mammals—the egg-laying monotremes, found nowhere else in the world outside of Australia and the neighboring island of New Guinea, and the pouched marsupials, of which the American opossums are the last lingering remnant outside Australia—both were world-wide groups in ancient times. The marsupials, all relatives of the kangaroo, have evolved into a whole varied fauna, supplying all of the varied life forms needful to stock the continent, which is slightly larger than the United States. The kangaroos are the swift grass-eating plains-animals of Australia, taking the place of our deer. The wombat, another mammal which carries its young around in a pouch like the kangaroo, corresponds in habits to our ground hog. The phalangers replace our squirrels, and there are even flying phalangers, very like our flying squirrels. The so-called Australian opossums replace our opossums and raccoons. There were formerly carnivorous marsupials in Australia, but these now persist only in Tasmania, having been exterminated in Australia by the dingo dog in comparatively recent time. Just when the first native blacks came to Australia is not sure, but it was in recent times, as time is reckoned in Australia, and while these native black men are the most primitive of men, the giant prehistoric marsupials disappeared after man arrived on the scene, and it is quite probable that he was responsible for their extermination.

Since the advent of the white man, the ancient life forms of Australia have continued to decrease, due both to hunting and to the destructive influence of man and his introduced rabbits, foxes, sheep, and cattle.

The plant life of Australia belongs to the same broad families as occur elsewhere in the world, but many of the genera are entirely Australian, and more than four fifths of the native plants are found nowhere else in the world. The greater part of the distinctively Australian forms are of dry-land types, with leaves reduced in size or absent. Thus the Acacias, which usually have large, spreading compound leaves, have their leaves reduced to narrow, flattened leaf-like petioles in many of the Australian species. The numerous Eucalypti are the principal timber trees, including some of huge size, such as *Eucalyptus regnans* and *E. pilularis,* sometimes twenty feet in diameter and over three hundred feet tall, and the tallest tree in the world, the Karri (*Eucalyptus diversicolor*), said to be four hundred and twenty-five feet tall! There are many strange forms of plant life, such as the so-called grass tree (*Xanthorrhoea* spp.), of the lily family, with tall black, palm-like trunks and grass-like leaves; the West Australian Christmas tree, a root parasite that grows into a good-sized tree, twenty-five feet high, but which lives as a parasite on the lowly shrubs and herbs around it in the semi-arid sand plains. Another parasite, the mistletoe on the Eucalyptus, develops foliage just like the Eucalyptus in shape and appearance, and it in turn has another kind of mistletoe as a secondary parasite on it. Other characteristic Australian plants, the Grevilleas, Casuarinas, and Hakeas, also have reduced or modified leaves, to reduce water loss by evaporation. Water is a precious asset to be carefully husbanded in most parts of Australia. As in all semi-desert regions, there are also a number of ephemeral or bulbous plants, which spring up quickly after rains, mature early, and persist as seeds or as bulbs underground until the next rainy period.

In contrast to the dry interior of Australia, the east coast and seaward slopes of the high mountains are well watered, and support a luxuriant forest of Araucarias, Ketleerias, Agathis, Podocarpus, tree ferns, and many trees and plants which are closely related to the Malaysian flora, as well as some more strictly Australian plants. Of the tropical Malaysian forms may be cited the palms, Cedrela, figs, staghorn ferns, and orchids, including some highly ornamental Dendrobiums, etc.

Several of the Australian native plants have been introduced into cultivation as ornamentals—the Everlastings (Helichrysum

and Helipterum), blue lace-flower (*Didiscus caeruleus*) and Brachycome; Grevilleas, Araucarias, Acacias, Eucalypti, and Casuarinas.

There is also a restricted high mountain flora, composed of temperate climate plants, partly of familiar northern genera—Rhododendron, etc.—and partly, apparently Antarctic in extraction.

Introduced weeds have proven as upsetting as the introduced mammals. Prickly pear (Opuntia) has usurped large areas in Queensland and in the arid regions; thistle, European rose, and bramble (Rubus), cockleburr, etc., have spread widely.

The principal industry of Australia is stock-raising; sheep for wool, and cattle primarily for dairy purposes. In both of these Australia has taken a forward place. Her wool is the finest in the world, and her pure-bred stock is sought after everywhere. In agriculture, wheat is the principal crop. Third in importance among the industries is mining, coal being the most valuable product, though many metals, including gold, silver, lead, copper, zinc and tin are mined in paying quantities.

Forestry is interesting more because of its spectacular features than of its magnitude. The Eucalypti are the principal native timber trees; Araucarias, Agathis, and others are used, but are less important. The California Monterey pine (*Pinus radiata*) is called the "Remarkable Pine" in Australia, and has proven truly remarkable because of its tremendous yields of timber. Thirty-three years after planting, the trees attain a height of over seventy feet, a diameter of about two feet, and have yielded as high as 100,000 feet of timber per acre, or at the rate of three thousand feet per acre per annum—nearly six times as great as white pine in the North-eastern United States. Planted Eucalyptus also yields well in Australia, as it does in California, but not nearly as heavily as does the pine. Also, the Monterey pine will thrive on the poor uplands, which produce only scrubby Eucalyptus trees.

Lumbering in the native Australian timber is carried on mainly in West Australia, Victoria, and Queensland. Oxen are used extensively in logging operations, this primitive means of transportation being often used in the most up to date mills.

Since the principal industries of Australia are essentially rural stock-raising, farming, and mining, it is rather surprising that the majority of the population in several of the Australian states—West Australia, South Australia, etc., is in the capital cities. This urban congestion is aggravated by the immigration of Englishmen from the large industrial cities. The restriction of immigration of Asiatics and other races has slowed up the settlement of the country, so that the present population of Australia is scarcely five million, compared to our one hundred and twenty million, in an area of comparable size.

The isolation of Australia in geological times made her into a remarkable continent, different from all of the rest of the world, and the present policy of the Australian government, which is progressive in its labor policy and its fostering of industries, is nevertheless tending to maintain the isolation of the continent by restricting immigration to the white race, and giving preference to the English. The devastating effects of the invasions of new animals and weeds—the rabbits, foxes, cactus, and lantanas—have taught the Australians to be cautious about permitting new inroads from the over-populated centers of Asia.

About forty colored lantern slides were used to illustrate this lecture, and the lecture platform was decorated entirely with plants important or interesting in the Australian flora; Araucarias, Callitris, Eucalyptus, Hakea, Grevillea, Melaleuca, and Casuarinas, representing the strictly Australian or particularly Australian forms: Staghorn ferns (Alcicornium), Australian palms and Ficus, representing the Malaysian element; and the prickly pear (*Opuntia stricta*) as an example of one of the worst introduced plant pests.

FORMAN T. MCLEAN.

COURSES OF STUDY OFFERED AT THE NEW YORK BOTANICAL GARDEN, 1930–31

Three courses in botany and gardening will be given at The New York Botanical Garden this autumn and winter. These are planned particularly for teachers who wish to continue their studies and for people interested in horticulture and are open to anyone who has sufficient previous training to be able to carry on the work. The courses are as follows:

1. Plants and Their Home Environments, Dr. Forman T. McLean and other staff members. Tuesdays at 4:10 P. M., beginning September 9th, fifteen double sessions, one half time field work and one half lecture or class work. Fee $8.00. Combines outdoor observations of native plant associations in woodland, meadow, pond, and rock cliffs, with lectures on plant life, both native and exotic, and studies of some of the outstanding exotic plants, particularly economic plants, in the grounds and greenhouses of the Botanical Garden.

2. Plant Relationships, Director Elmer D. Merrill, and members of the Botanical Garden staff. Tuesdays at 4:10 P. M., beginning February 17th. Fee $8.00. Double sessions, one half time field or laboratory study, and one half lecture. This is a survey of the great groups of plants algae, fungi, hepatics, mosses, ferns, conifers, grasses, and higher flowering plants, with special emphasis on the easily available native materials suitable for classroom use.

3. How to Grow Plants, Dr. Forman T. McLean and staff of lecturers and gardeners. Saturdays, 2 to 4:30 P. M., ten triple sessions, beginning December 6th, recess during Christmas holidays. Fee $10.00. This is a series of lectures given in the Greenhouse on growing plants indoors and in gardens, with practical instruction in sowing seeds, making cuttings, potting, transplanting, fertilizing, watering and all phases of the care of growing plants. The lectures will be by authorities on the different phases of the work, drawn both from the garden staff and from other establishments.

For further information write to Dr. Forman T. McLean, Supervisor of Public Education, The New York Botanical Garden, Bronx Park, New York, N. Y.

PUBLIC LECTURES DURING SEPTEMBER, OCTOBER, AND NOVEMBER

The following is the program of the free public lectures during September, October, and November, 1930. The lectures are given in the Museum Building on Saturday afternoons at 3:30, and are illustrated by lantern-slides and otherwise. Late-comers are admitted at 3:45.

September 6. "Beardless Iris and Iris Species," Mrs. Wheeler H. Peckham, Honorary Curator of Iris and Narcissus Collections.

September 13. "Unusual Plant Occurrences Around New York," Mr. Raymond H. Torrey, Torrey Botanical Club.

September 20. "Along the Canadian Labrador," Mr. Howard Cleaves, Explorer and Lecturer.

September 27. "Dahlias," Dr. Marshall A. Howe, Assistant Director. (Exhibit of living Dahlias.)

October 4. "One Thousand Miles Down the Yukon by Canoe," Dr. Arthur Hollick, Paleobotanist.

October 11. "In Distant Forests," Mr. James A. G. Davey, Sound Beach, Connecticut.

October 18. "Insects in Relation to Plant Life," Dr. E. P. Felt, Director and Chief Entomologist, Barlett Tree Research Laboratories.

October 25. "Bananas," Dr. Forman T. McLean, Supervisor of Public Education.

November 1. "Aconites and Other Drug Plants," Professor W. J. Bonisteel, Instructor of Pharmacognosy and Botany, Fordham University.

November 8. "Big Trees of California," Dr. H. A. Gleason, Curator.

November 15. "Plant Hybrids," Dr. A. B. Stout, Director of Laboratories.

November 22. "California Plant Life," Dr. Elmer D. Merrill, Director-in-Chief.

November 29. "A Winter in Bermuda," Dr. Fred J. Seaver, Curator.

NOTES, NEWS, AND COMMENT

Col. William Boyce Thompson died at his home in Yonkers, N. Y., on June 27, in his 62d year. A man of extensive business interests, he was widely known to botanists as the founder of the Boyce Thompson Institute for Plant Research in Yonkers and the Boyce Thompson Southwestern Arboretum at Superior, Arizona. From 1921 to 1927, inclusive, Mr. Thompson was a member of the Board of Managers of The New York Botanical Garden.

The New York Botanical Garden's 1930 collection of dahlias includes 1096 plants, representing 398 of the better and newer varieties. It occupies fresh ground in what was once "the old orchard," south of the railway station plaza, where the plants seem to take kindly to their new surroundings. A considerable number of new varieties, never before exhibited here, have been contributed by Broomall, Success Dahlia Gardens, Ballay, W. H. Waite, Peacock, Fisher & Masson, Dahliadel Nurseries, Chemar Dahlia Gardens, Redfern, Hodgens, Chapman, Lyndora Gardens, Meussdorfer, Fraser, Alling, Harley T. Peck, and other well-known originators. An attempt is being made to have the display labels conform to the revised classification of garden varieties of dahlias recommended in a recent report of the Nomenclature Committee of the American Dahlia Society, of which Dr. Howe is chairman. There has been a strengthening of the display of the small pompon dahlias, the popularity of which is rapidly increasing. This group is represented by 114 plants, of 46 varieties.

Meteorology for August. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 95° on the 3rd; *99° on the 5th;* 76° on the 11th and the 17th; 83½° on the 18th; and 89½° on the 30th. The minimum temperatures recorded were: 58° on the 1st; 64° on the 11th; *52° on the 12th;* 55° on the 24th; and 59° on the 26th. The total precipitation for the month was 2.74 inches.

ACCESSIONS

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IRIS STUDIES IN THE GULF STATES

Opportunity was afforded last spring for a more thorough than usual study of the native irises of the Gulf States. Attention was devoted largely to the two main iris centers of that region, namely, Florida and Louisiana. However, the Florida iris fields being fairly well known, only limited time was devoted to them, but further observations were made on the seven species native in that state.

Seasonally, the irises of Florida fall into two groups early-flowering and late-flowering. The first group contains five species, *Iris carolina, I. savannarum, I. Kimballiae, I. rivularis,* and *I. Albispiritus*; the second comprises two species, *Iris hexagona* and *I. tripetala.*

In the peninsula, in mid-March, the iris season was well under way, in some places nearly over. However, our main object was accomplished, namely, the photographing and collecting of *Iris Albispiritus.* In northern Florida, the plants representing the second season had not yet come into flower.

Reports from the Mississippi Delta led us to hasten to our headquarters in New Orleans.

The remarkable natural iris fields discovered in southern Louisiana in 1925 have been visited by the writer several times previous to this year, for short periods.

The discovery was a mere incident, en route, on a botanical trip from Florida to western Texas. The iris display between Lake Pontchartrain and New Orleans was so unusual that several plants were packed in passing and mailed to the Garden. These flourished in the cold frames and flowered the following spring.

Each succeeding spring, up to and including this year, brought more Louisiana iris plants to the Garden plantations. In 1926,

FIGURE 1.—In the flatwoods along Twelve-mile Creek near the Caloosahatchee, Florida. *Iris Albispiritus* growing along a pool. This white-flowered iris inhabits the flatwoods on both sides of the Caloosahatchee. Photo by W. M. Buswell.

FIGURE 2. *Iris savannarum* growing on the edge of a cypress-swamp near Arcadia, Florida. This "blue" iris is the typical prairie iris of Florida, where it is confined to the peninsula. It also inhabits hammocks and cypress swamps.

1927, and 1928 comparatively few plants were added to the growing collections, but much was learned about the habitats and habits of these irises of the lower Mississippi Delta. In the spring of 1929 extensive collections were made and additional plantations were established in New Jersey, Maryland, and Florida.

In the meantime it was learned that these irises native in the gumbo near the mouth of the Mississippi were hardy in the climate of the latitude of New York and that they flourished in the ordinary soils of that region.

Enough material had been assembled and studied to indicate the magnitude of the iris development in the vicinity of the mouth of the Mississippi River.

Fortunately for our iris studies, the past spring (1930), curiously enough, following a very severe winter, was especially favorable, for the flowering season lasted for a period of two months. The plants flowered profusely. Mr. Alexander and the writer spent six weeks in continuous field work about New Orleans and at several localities remote from that city. We are indebted to numerous friends resident in that region for their helpful coöperation.

At least 8000 plants were sent to the Garden and to other cooperating northern plantations in which southern irises are being given a trial. These are intended, along with those collected in former years, for study, hybridizing, and propagation, and ultimately, in large part, for distribution to other iris plantations in America and in the Old World.

Mr. Alexander's color notes and descriptions based on sepals, *i.e.*, the color of the blade and of the crest, indicate some 200 distinguishable forms, which may be summarized as follows:

six various shades of violet-blue, with about fifteen different combinations of crest and color;

four various shades of lavender-blue, with about twelve different combinations of crest and color;

eleven various shades of violet, with about forty different combinations of crest and color.

seventeen various shades of red-violet, with about thirty-five different combinations of crest and color;

fourteen various shades of lilac, with about twenty-five different combinations of crest and color;

FIGURE 3.—A small colony of *Iris giganticaerulea* on the prairies south of Pointe-à-la-Hache, Louisiana. This species has the same status in Louisiana as *Iris savannarum* has in Florida. Like the latter species, it often covers vast areas on prairies, particularly towards salt marshes.

FIGURE 4.—An iris of the "blue"-flowered group in the bayou hammocks near New Orleans. This species usually occurs in colonies of several hundred plants. It is one of the tall species and bears deep-violet flowers.

nine various shades of cerise and magenta, with about eighteen different combinations of crest and color;

fifteen various shades of pink and old-rose, with about twenty different combinations of crest and color;

twenty-six various shades of red, orange-red, and orange, with about thirty-five different combinations of crest and color.

The flower and fruit of one of the new species discovered in the spring of 1925 was published in 1927,[1] as *Iris vinicolor.*

This was one of the "red"-flowered kinds. Its publication resulted in the sending of thousands of miscellaneous iris plants from the vicinity of New Orleans, through the state inspection office, to many parts of the United States, and there is no telling how many were "bootlegged" out of the State of Louisiana. The publication of six additional new species, *Iris violipurpurea, I. giganticaerulea, I. chrysophoenicea, I. miraculosa, I. chrysaeola,* and *I. atrocyanea,* in 1929,[2] resulted in further drafts on the fields of southern Louisiana. There, seemingly large depredations have had no visible effect on the iris fields, the richest of which lie in the immediate vicinity of New Orleans, so far as is at present known. We are safe in assuming that they have not been so disastrous to the natural growth of iris there as has been the growth of the city for two centuries. The number of plants destroyed and perhaps the kind of species exterminated through the drainage and filling of the city will never be known.

At the present stage of the study nearly fifty species and a number of natural hybrids are indicated.

Our usual criterion for assigning the status of species is an isolated colony, persisting through propagation by rootstocks and an annual accretion of seedlings without any variation in the characters of the perianth.

This remarkable local development of iris in the tip of the Mississippi Delta is as yet inexplicable. Aside from its magnitude, the outstanding points are the often vast colonies of species, the great range and combination of colors, and the unusual size of the plants. Flowering stalks six feet tall are not unusual. Stalks seven feet high have been found during our explorations. In such cases a six-foot man has to look up in order to see the

[1] Addisonia **12**: 1. *pl. 365.* 1927.

[2] Addisonia **14**: 1–4. *pl. 449, 451–455.* 1929.

terminal flower. In view of these facts, the Lower Mississippi Delta natural iris field constitutes the one most spectacular botanical and horticultural discovery in North America from the standpoint of a single genus within such a limited area.

JOHN K. SMALL.

BEARDLESS IRIS AND IRIS SPECIES[1]

The genus Iris is a large one, the various species and their hybrid forms being found in a band completely around the northern half of the world from well up towards the arctic circle to the end of the semi-tropics on the south. Below this line we get closely allied plants, such as Moraeas, Gladioli, Sparaxis, Ixias, etc., but no real iris. Australia and New Zealand, although they may have cooler weather in some parts, have no native irises but two or three "Sylphs," to use the local parlance, grow there which botanically are classed as Moraeas.

Irises fall into several large natural groups arranged according to their most noticeable differences and the differences in the culture in most cases follow these same group lines. These divisions are *Bearded,* plants having a conspicuous signal or beard on the lower perianth segments or "falls"; *Beardless,* plants with no such signal; *Bulbous,* those with roots in the form of bulbs; *Oncocyclus,* those with thickened root-stocks, one flower to a stem and seeds with conspicuous white arils almost as large as the seeds themselves; *Regelia,* like the Oncocyclus but with more than one flower to a stem. Besides these there are hybrids between groups and in some of the larger groups there are numerous subdivisions.

The Bearded group is perhaps the best known to the general public and much hybridizing is now being done to produce fine varieties for our gardens. There are few real species in this group; what we think of, perhaps, as species are collected wild hybrids and forms of a very few species; thus it is hard to draw the line and say just what is and what is not a species. A species should be a sort that comes true from seed. That means true to

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on the afternoon of Saturday, September 6, 1930.

shape and other characteristics, though the size and color may vary considerably. So many of the old Bearded varieties that we have in our gardens that have been collected as "wild" are completely sterile or when they do produce seed give such variations that it is generally conceeded they are nothing but old, old hybrids—perhaps produced naturally between two or more species—but hybrids just the same. This makes the work that is done by the usual Iris hybridist of the present day begin right in the middle and scientists cannot feel that the results give any conclusions based on more than guesswork. In old gardens there were such species as *Iris pumila, I. Chamaeiris, I. aphylla, I. variegata, I. pallida,* and the hybrid(?) *I. Swertii.* Probably the earliest crosses were made by bees between these species in and out of gardens. Certainly, our knowledge as to when man really began to do the pollenization shows the date as so late and the horticultural and botanical worlds so full of irises that surely are hybrids that the problem is a very serious one. The hybridist would hardly know where to begin or what lines to work on to come to results within his lifetime. One brave man, Mr. Paul Cook of Indiana, has set to work purely with the idea of deciding some of these questions. Not for him the production merely of a large and handsome garden subject and the discarding of all the rest. No, he makes his beginnings only with species or supposed species. He checks carefully all the seedlings and their variations. All results are tabulated. His iris fields show ugly and "poor" varieties but he and Mrs. Cook have put ten years of hard labor on this background work and expect to continue it. He now sees that many theories at present held by breeders can be exploded and we are anxiously awaiting the publication of his findings. For instance, in tulips we feel there is a ground color with other colors superimposed. After a time, if the bulbs are submitted to certain conditions (which some people now say may be caused by disease or insects) the color "breaks." The ground-color still stays but the upper colors recede, causing veinings and featherings of concentrated darker colors. Now, we have irises that are feathered and we call them "Plicatas." *Iris Swertii* is of this style, a white ground and a feathering or "button-holing" on the edges of the falls of lavender purple, while the petals or standards are a dirty white with faint markings of the lavender. Mr. Cook says that

his research has convinced him that the feathered irises are the original and correct color form and the suffused color (which we know as "self") is the freak. This seems very surprising and gives rise to many speculations. We have veining on native irises of this country but it is more or less confined to heavy dark masses near the crests and ridges where crests would be, and spreading veins that run out towards the edges from the ridge or from the haft. I can think of no case where the color is confined to the edges and fades towards the centre as is the case in these Plicatas of the Bearded group. Other Bearded species that have been used in more modern work are *I. cypriana* and *I. trojana.* These are tall, well branched varieties and have been excellent for bringing better "spacing" of flowers and wider branching into the group.

The Bulbous group is divided into several sections, the most important being that headed by *Iris reticulata.* Here the bulbs have a fibrous covering which is criss-crossed like a net, hence the name. There are several species and quite a few hybrids, though few are in cultivation in the United States. The plants are short of stature and the bulbs small. A rock-garden is indicated as a suitable location. The *Juno* irises are a subdivision of the Bulbous group. These bulbs have large, fleshy roots which are retained while dormant and as the plants come, practically all of them, from desert regions or places that have long dry spells, they need special treatment. *Iris xiphium* is a bulbous iris and heads a division with numerous species, collected and garden forms. This is the most widely distributed set of bulbous irises of any, while the section formed around *I. xiphioides* in the wild state is confined to only one part of the Pyrennees mountains. These so-called English irises have been "improved," crossed with the Spanish varieties and with *I. filifolia* and a race called Dutch irises have been obtained. *Iris filifolia* is of African origin and is not hardy here itself.

The Oncocyclus group is little known in this part of the United States. The members of it are difficult to deal with as they come from countries that have a long period of drought during which the plants get a complete rest and do not grow at all. Unless we can give them these conditions we have no success. Some varieties come from Palestine, Syria, and Mesopotamia and are rather

tender, not accustomed to our cold winters. Others from eastern Asia Minor and western and northern Persia would be hardier but they must all be dry part of the time. Here this is difficult to manage and some people accomplish it by lifting the plants directly the bloom is over and storing them in dry sand until October when they are replanted. Mr. Wayman of Bayside, Long Island, grows his in frames with hinged glass lights that are opened during the blooming season and closed most of the summer. The difficulty with keeping the plants in a frame is that with any bottom moisture the plants do not rest and growth starts too early in the autumn. This new growth is partially destroyed with winter cold and then there is no bloom and after a year or two the plants are weakened and die. *Iris susiana,* however, grows very well in a hot, dry quarry I know of outside of Philadelphia. It is never lifted but is absolutely dry below for several months in summer, has a natural covering of rough grass for winter and the protection of a back-wall of stone that radiates heat with the slightest shine of the sun. The plants of this group like a soil well mixed with sand and mortar-rubble, object to stable manure, and enjoy lime. Commercial fertilizer suitable for vegetables may be used in very small quantities to stimulate growth. Crosses have been made with the Oncocyclus and Bearded irises, a famous example being Iris William Mohr. This iris, introduced in 1925, is a good grower and seems fairly hardy and may be treated the same way as the usual Bearded iris. Mr. E. B. Williamson of Bluffton, Indiana, raised an Oncocyclus hybrid, Maud Tribolet, about fifteen years ago, which apparently disappeared from view but has turned up in the garden of Sir William Lawrence in England, where he grows it very successfully—so much so that he received favorable comment upon it at the big iris show in London this year. Crosses have been made also with the Regelia group, particularly by the firm of Van Tubergen in Holland. Some of these hybrids have conspicuous beards and some only widely diffused hairs which hardly constitute a beard and some have so few hairs one would almost call them beardless. Among hybrids made between two groups some will resemble one group more closely than the other, causing confusion in the mind of the uninitiated.

The really Beardless irises never have a beard, though they may have a pronounced ridge where the beard would be and this ridge is usually a brilliant white or yellow, serving to attract insects to the place where they should alight. There are many divisions to the Beardless group, the largest being, perhaps, if we consider only species, that known as the Siberian division. If we were to include all the hybrids the Kaempferi division would be quite the biggest, as the garden varieties are legion. I suppose the three largest divisions are the Siberian, Kaempferi and Hexagona. In the Siberian the two principal species are *Iris sibirica* which branches rather low down the stem and *I. orientalis,* branching near the top. *Iris sibirica* is a native of Europe, though it is widely spread and forms turn up in Asia. In this country perhaps the nearest to it is *I. prismatica.* The Laevigata section is best known by *I. Pseudacorus,* which is of European origin also and has become "naturalized" in a number of places here. This is the true Fleur de Lys of France and not the white Iris Florentina which is so often mentioned in this connection. Our principal American representative of the Laevigata division would be *I. versicolor,* the ordinary swamp Blue Flag of the northeastern United States. To go back to the Siberian group, *Iris orientalis* has been collected in an albino form and named Snow Queen and there are newer and handsomer white hybrids, Snow Queen having been one of the parents. A fine collected form, Emperor, is a dark blue, while a hybrid, Red Emperor, is quite red and blue. The divisions of the Beardless group have been arranged alphabetically in the American Iris Society Check List of 1929 and if we were to follow that list we should now come to the California section. There are many of these California and western irises, incompletely studied at present, the best known being *Iris Douglasiana* and *I. tenax.* These plants all have fibrous roots with such tiny rhizomes that they dry out almost at once after digging, making transportation difficult. They grow easily from seed, so it is really advisable to start them that way and, for these California sorts where seeds are so small, pots in a green-house or small boxes in the house are the best method. With Sibiricas, seed can be sown outside in October, mulched with an inch of granulated peat-moss and the plants will appear in spring. Irises of the California section are charming in the rock-garden as most of

them are slender-stemmed and short of stature. Another subdivision is the Chinese, to which belong the yellow *Iris Forrestii* and *I. Wilsoni,* and the blue *I. Clarkei.* The best-known species, however, is *Iris chrysographes,* a rich red-purple with gold markings. It is difficult to get the real thing from nurseries, as there seems to be a form of *I. Kaempferi* substituted for it. *I. ensata* belongs to a division of its own. Here the foliage is extremely tough, the flowers, though they are borne freely, are almost hidden by the leaves. A pale blue form named Hyacinthiana has longer stems and is best for the amateur. Raise this iris from seed and be patient. It needs to be established to bloom.

The crested or Evansia irises, those with crests instead of beards, have been included with the beardless group by the American Iris Society and would be encountered by us next. *Iris tectorum,* from China and Japan, has been romanced about many times. It is grown on roofs in Japan, so many legends have been fabricated about it but I believe legends always grow up after a thing has been put for a practical purpose in an unusual place. *Iris Chamaeiris* is grown on thatched roofs in France, not because face-powder or perfume was made from it and it was forbidden during famine and war (as is told about *I. tectorum*), but for exactly the reason *I. tectorum* is put on roofs—to hold the thatch and to keep out leaks! A beautiful crested iris, *I. japonica,* is not hardy here and must be grown in a greenhouse. *I. dichotoma* belongs to the same division, is hardy, and is easily raised from seed. It blooms in late August and early September. The gardener should sow the seeds each year to keep a succession of plants, as it is short-lived. The flowers are small for the length of the stem, but they keep opening each afternoon for several weeks. We have some native crested irises, perhaps the prettiest being *Iris cristata* and it seems the easiest to grow. Semi-shade and a well-drained location are general requirements. The white form is especially beautiful, as is that of *I. tectorum* mentioned before. These with our native crested irises are all good plants for the rock-garden in semi-shaded positions.

The Fulva division may prove to be larger than was at first thought, as a number of forms are being discovered. *Iris fulva* is distinctly different from other irises in that it is a brick-red, a color rarely found in irises. The bearded variety nearest to this

color is Apache, which is tawny but blended with many other colors. *Iris fulva* has a number of forms, some light, some dark, some large and tall, some small and short. There even is a yellow, which is probably the albino. This iris has been used to cross with plants of other groups, notably *Iris foliosa.* The hybrids vary tremendously and a charming pink of *fulva* habit is known while Fulvala and Dorothea K. Williamson are red-purple and blue-purple with the characteristics of *I. foliosa.*

After this comes the Hexagona group, named for an iris native of the coast along the southeastern United States. Dr Small calls this the "botanical Iris wastebasket," as so many of our native irises have been collected and sold for *I. hexagona* that the true *hexagona* is little known in horticulture. The most beautiful member of this division is *Iris chrysophoenicea,* found by Dr. Small and Dr. Wherry in southern Louisiana. It is quite hardy up here and is a magnificent bloomer, a rich red-purple with gold markings, broad flowers with wide segments, strong stems that hold the flowers up well—a gorgeous garden subject and one well worth introducing to the horticultural world. *Iris foliosa* has been known for some time. It is decorative when cut for use in floral arrangements but its habit of sprawling on the ground makes it unsuitable for garden use. *I. flexicaulis* is another that behaves in this way, only even more so. The flowers have hardly any stem at all and are found practically on the ground at the base of the leaves. *Iris giganticaerulea* will prove useful in our gardens. It is tall and the flowers are showy, being a good light blue and it seems to grow with little difficulty in the vicinity of New York. A native iris with a distinctly red-purple color is *I. chrysaeola,* another of the beautiful plants found by Dr. Small in the lower Mississippi Delta. While this is not quite so startling a flower as *Iris chrysophoenicea,* it is very lovely and any gardener would be glad to grow both, even in a small garden. An attractive thing is *I. violipurpurea,* which gives just as fine an effect as any of the Japanese varieties, as it is broad and flat and a rich blue-purple. The treatment for these southern irises is a surprising one. In the north they do not care for positions where water stands in winter. They must not dry out too much in midsummer. They enjoy full sun but semi-shade does not harm *Iris vinicolor.* A covering of peat-moss is certainly very beneficial, as it helps retain moisture,

acts as a protection during early frosts. A very light covering of salt hay held up by branches of deciduous trees or shrubs is worth while, as growth made during late summer is retained. Where the plants are well established and there is a mat of leaves, no covering other than the peat moss seems to be necessary. Some of these plants make heavy growth during summer, some do not, and one has to watch and use one's judgment about the amount of cover required. Too heavy a cover is worse than none. Some sheep manure and wood ashes added between the plants in early spring stimulates them but care should be exercised that the plants are not given too much, so they grow too rapidly and make weak stems. In our climate near New York these irises do best on level ground. It might be inadvisable to use lime, just as in the case of the Kaempferi division, popularly known as Japanese irises. These are miffy things and are best kept in a bed together where one treatment can be given. Experiments in their culture are being carried on at the Brooklyn Botanic Garden. I think we know very little about the culture of most of the Beardless irises. It is supposed to be very easy but the plants die just the same. Certainly most of the losses come through the ravages of the iris borer, which attacks these varieties just as much as the Bearded sorts. The borer is harder to deal with here, too, as he does not show up so easily among this narrow foliage and one cannot lift and reset the plants with the facility that one can handle other groups. If there are many leaves turning brown the plant may be suffering from root rot. This can be treated with semesan. A solution of one tablespoon of semesan to five gallons of water may be poured about the plant or the dry material can be worked into the soil. This is expensive but seems to save many a rare iris.

Iris foetidissima cannot be grown here out of doors with success but we can have the Spuria group, of which there are many handsome ones. They are treated just like the Siberian irises and may even be put along streams if above the water where their roots are not liable to rot in winter.

Among new divisions of Beardless we have Trigona, and to this belongs the blue *I. savannarum*. Maybe this is not so exquisite as *I. giganticaerulea* but it flowers very well and would be a fine thing for naturalizing. It grows freely, making sheets of color in Peninsular Florida and is well named, Prairie Iris.

Iris tripetala from the southeastern United States is another plant about which a division has been built. Here the petals are so tiny as to be almost non-existent and the "falls" are of good size. This plant is troublesome to grow in our climate and hard to transplant. It is a late bloomer, coming into flower with us after all the other native irises. A white form is a dainty, pretty thing worth struggling with. To this section belong the little *Iris canadensis,* known formerly as *I. Hookeri,* and *I. setosa canadensis,* and the larger *I. setosa* of China and Alaska. In the last division we find those irises closely related to the striking *I. vinicolor,* which comes from Louisiana. The wine-colored iris is effective in the garden and, after one has a good clump of it and can bring himself to cut the large stalks, it is a splendid subject for floral arrangement, as flowers will open one after the other and the bouquet may be kept for a number of days. Combined with very pale pink or dark blue annual larkspur, it makes an unique display. These newer native irises will be introduced to commerce very shortly, as a supply with check plants is being sent gradually to a reliable dealer, who will propagate and introduce them very soon now.

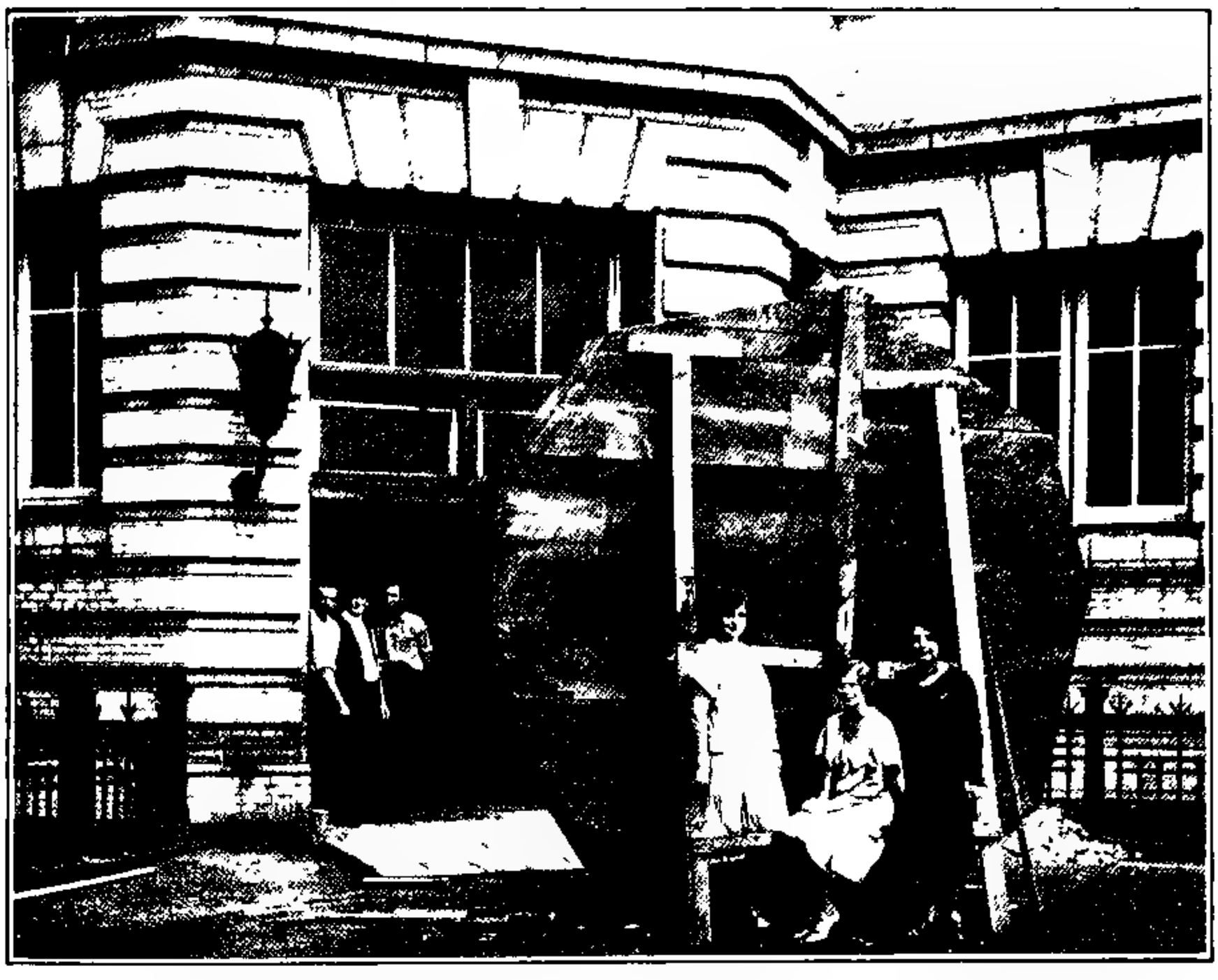
ETHEL ANSON S. PECKHAM.

A "BIG TREE" SECTION REACHES THE GARDEN

The New York Botanical Garden has just acquired a cross section of the trunk of the California big tree (*Sequoia gigantea*) for its museum. This section is about ten feet in diameter and is now being installed. When finished and in place, it is planned to work out the exact age of the tree from which it was taken, and then indicate on the annual rings the more important historical dates with special reference to American and New York history. It is estimated that the tree from which the section was taken was between 1200 and 1500 years old when it fell in 1914.

For this important addition to its museum exhibit the Garden is indebted to Colonel Charles R. White, Superintendent of the Sequoia National Park in California. Colonel White made all arrangements for cutting and crating the section in the Sequoia National Park, and arranged for its transportation by truck to the

nearest railroad station at Lemon Cove, California. The Luckenbach Steamship Company voluntarily supplied free transportation from Oakland, California, to New York, a very material contribution to the garden in view of the size of the section, and its weight which approximated 5000 pounds. The institution is under deep obligations to Colonel White, representing the National Park Service, and to the Luckenbach Steamship Company for their contributions. Because of the large size of the section (as seen in the illustration), it was found that on delivery it could not be



brought into the museum building except by temporary removal of the doors and transoms.

There is an excellent section of the California "Big Tree" in the American Museum of Natural History, and sections are to be found in a few other institutions in America and in Europe. It is felt that when this exhibit is properly installed an important addition will have been made to the museum exhibit at the Botanical Garden.

E. D. MERRILL.

PLANT ECOLOGY COURSE STARTED

At the second session of the course of study of Plants and Their Home Environment at The New York Botanical Garden, Professor George E. Nichols, head of the Botany Department at Yale University, gave a most interesting talk on the successive changes that are constantly taking place in the plant life around us:

1. How the old fields on abandoned farms of this region gradually change from grassland by the growth of juniper, cedar, sumac, and bayberries, followed by gray birch and by oaks and hickories, and, if the situation is a favorable one, finally by hemlock, beech, and sugar-maple forest.

2. He further told how high rocky ridges of trap rock developed first a coating of lichens, then mosses and finally grass and then the hardier kinds of trees, such as post oaks and red cedars. If the disintegration of the rock and the soil continues, there may even result a forest of mixed oaks and hickories. This change is so slow that in twenty years' time successive pictures of the same area showed no progress that we could observe, but in a number of other instances, as in the revegetation of a sand plain, he showed the changes that occurred in fifteen or twenty years by successive pictures of the same area taken from the same point.

3. On the sand dunes and on sandy lands, such as those of Long Island, the first growth is of small and scanty herbaceous perennials. These do not prevent the drifting of the sands. The next step is the growth of bunch grass, which binds the sand together by its perennial roots. As this sprouts and completely covers the land, we first get a grassy prairie, next a development of shrubs, such as sweet fern, then the first of the pioneer trees, the pitch pine, takes possession. These trees need full sunlight and cannot develop under their own shade but where the pitch pines have protected the ground and reduced evaporation the more shade-enduring oaks, such as blackjack, scrub oak, and others come in and sometimes even oust the pines.

4. In lakes and ponds, the process of change is just as apparent and here it is essentially a leveling process, in other words, socialism carried to the extreme. First, submerged plants grow up in the bottom of the pond, then as the sediment and plant remains

build up the water level and the edges of the pond become as shallow as six feet deep, the water lilies with floating leaves form a fringe around the borders. These are particularly attractive to the wild fowl and the wild animals because of their succulent, juicy roots. As the waters become still shallower and gradually fill in with plant remains, then the cat-tails and pickerel weeds take possession and in turn smother out the water lilies. As the built-up earth emerges above the water then sedges and marsh grasses take possession of the saturated soil and these are gradually driven out by the taller shrubs, such as alders and in the moist shade, the first of the forest trees, such as maple and ash, take possession, with the shade-loving rhododendrons beneath them. Along the seashore and the brackish water, the maples and ash are replaced by the more salt-enduring white cedar. Thus, the original pond area is gradually filled up and converted into flat forest land.

5. Sometimes in poorly drained areas, where the water is acid because of decaying vegetable matter, then there is a different type of development over the ponds, the floating bog type. Here the sedges form mats out over the water, sometimes two feet deep, with clear water underneath and the pond is gradually filled up by the deposits of decaying vegetation dropped down from above. As these floating bogs become anchored to the shallow bottom, then, sphagnum moss with some of the odd insectiferous plants, such as the sundews and pitcher plants, develop. These are followed by swamp blueberries and finally by black spruce, white alder, and other woody plants.

6. He also described the changes taking place on flood plains and rivers, where the ground is built up by deposits of silt rather than plant remains. Here the submerged aquatic plants anchored to the bottom are followed by wild rice, so much enjoyed by the migratory birds, then by poplars and willows, and finally by mixed forest of oak, ash, maple, and other deciduous trees. There are similar changes on our sandy beaches and in our salt marshes, always tending to produce flat dry land from the irregular or submerged areas. On the one hand, there is constant erosion of the land and flattening down of the hills by geological processes. On the other hand, vegetation covering the country has a tendency to level and to fill up the low places. These changes are constantly

going on about us and it is the study of such successions in plant life and of the conditions obtained in them that is considered here in this course. At The New York Botanical Garden we have several good examples of pond-filling and of the spread of forest trees into open areas.

The people enrolled in the course are:

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Mrs. Florence P. Ernst, 88 Buena Vista Drive, Dobbs Ferry, N. Y.
Miss Rosalie Weikert, 325 East 206th Street, Bronx, N. Y.
Mr. Edmund Baermann, 640 East 236th Street, New York, N. Y.
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Supervisor of Public Education.

NOTES, NEWS, AND COMMENT

A "Celebration of the Three-Hundredth Anniversary of the First Recognized Use of Cinchona" is to be held at the Missouri Botanical Garden October 31 and November 1. Papers are to be presented dealing with the history, culture, chemical composition, and medicinal uses of cinchona.

Mr. Paul F. Shope, Mycologist in the University of Colorado at Boulder, spent a few days in September at The New York Botanical Garden, looking over Colorado polypores. Mr. Shope is on leave of absence from the University of Colorado and will spend the year in graduate study at the Missouri Botanical Garden, St. Louis, Missouri.

Professor Sam F. Trelease succeeded Professor Robert A. Harper as executive officer of the Department of Botany of Columbia University on July 1. Under the terms of the Act of Incorporation of The New York Botanical Garden, Professor Trelease became on that date ex-officio a member of the Corporation, the Board of Managers, and Board of Scientific Directors of the Garden, in succession to Professor Harper.

The following visiting botanists have registered in the library during the summer: Mr. W. Clement Percival, Syracuse, N. Y.; Prof. W. T. Fitzpatrick, Ithaca, N. Y.; Prof. J. H. Clark, New Brunswick, N. Y.; Dr. Francis W. Pennell, Philadelphia, Pa.; Mr. Earl L. Core, West Virginia University; Dr. Walter T. Swingle, Dr. M. A. Raines, and Mr. V. H. Florell, Washington, D. C.; Prof. Shigeo Yamanouchi, University of Chicago; Mr. Howard S. Fawcett and Mr. Fred M. Reed, Riverside, Cal.; Prof. W. L. Jepson, Berkeley, Cal.; Mr. J. E. Higgins, Canal Zone Experiment Gardens, Summit, C. Z.; Mr. Carlos E. Chardon, San Juan, P. R.; Dr. George Stroh, Berlin, Germany; Mr. R. H. Compton, Kirstenbosch, S. Africa; and Mr. Felipe M. Salvoza, University of the Philippines.

On September 8th, Dr. Fred J. Seaver and Mr. Edmund H. Fulling represented The New York Botanical Garden at the "Get-Together" of the Bartlett Associates as guests of the F. A. Bartlett Tree Expert Company at Stamford, Connecticut. During the

forenoon a series of very interesting discussions of the various phases of tree protection work were given, the meeting having been presided over by Dr. E. P. Felt, former state entomologist of New York. Some of the topics discussed were: Japanese Beetle Quarantine; The Effect of the Recent Drought; and Notes on Birch Leaf-Miner, European Pine-Shoot Moth, and Spruce Gall Aphids. The afternoon was devoted to inspection of cavity-filling and tree-climbing by the Bartlett experts. One of the features of the day was a clambake given in the grounds of the institution. The entire occasion was both instructive and profitable.

Meteorology for September. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: *88° F on the 2nd;* 83° on the 12th; 86° on the 16th; and *88° on the 22nd and the 26th.* The minimum temperatures recorded were: 53° on the 4th; 51° on the 9th; 54° on the 19th; and *49° on the 29th.* The total precipitation for the month was 1.80 inches.

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LIBRARY ACCESSIONS FROM MARCH 21 TO APRIL 30, 1930 (CONTINUED)

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PUBLICATIONS OF

THE NEW YORK BOTANICAL GARDEN

Journal of The New York Botanical Garden, monthly, containing notes, news, and non-technical articles. Free to members of the Garden. To others, 10 cents a copy; $1.00 a year. Now in its thirty-first volume.

Mycologia, bimonthly, devoted to fungi, including lichens; $4.00 a year; single copies not for sale. [Not offered in exchange.] Now in its twenty-second volume.

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Memoirs of The New York Botanical Garden. Price to members of the Garden, vols. I–VI, $1.50 per volume; to others, $3.00. Vol. VII, $2.50 to members; to others, $5.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Vol. VII. Includes New Myxophyceae from Porto Rico, by N. L. Gardner; The Flower Behavior of Avocados, by A. B. Stout; Descriptions of New Genera and Species of Plants Collected on the Mulford Biological Exploration of the Amazon Valley, 1921–1922, by H. H. Rusby; and The Flora of the Saint Eugene Silts, Kootenay Valley, British Columbia, by Arthur Hollick. viii + 464 pp., with 47 plates, 10 charts, and 11 text-figures. 1927.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the thirteenth volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York, N. Y.

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Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
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A. B. STOUT

REPORT ON BOTANICAL STUDY IN EUROPE, 1930
H. A. GLEASON

UNUSUAL PLANT OCCURRENCES AROUND NEW YORK
RAYMOND H. TORREY

HARVESTING IRIS SEEDS IN THE GULF STATES
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MACDOUGAL'S THE GREEN LEAF
FORMAN T. MCLEAN

NOTES, NEWS, AND COMMENT

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JOURNAL
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BOTANICAL OBSERVATIONS IN EUROPE

The period which the writer spent in Europe during the past summer extended from July 8, the date of landing at Boulogne, France, to August 29, which was the date of sailing from London. The itinerary included several days in and about Paris, solely devoted to botanical work, followed by visits to gardens, arboreta, nurseries, and scientific institutions at Genoa, Naples, Rome, Florence, Milan, and Munich, followed by three weeks spent in England at Cambridge and in and about London.

As a delegate from The New York Botanical Garden, I attended two important congresses. One was the Ninth International Horticultural Congress, held in London on August 7–15, under the invitation of the Royal Horticultural Society, at which I presented an address on " The Inter-relations between Vegetative Reproduction and Seed-Reproduction." The other congress was the Fifth International Botanical Congress, held at Cambridge August 16–23, in the program of which I gave a paper on " Pollen-tube Behavior in Self-incompatibility." The programs of these conferences and the opportunities presented to meet numerous horticulturists and botanists afforded me much interest, profit, and pleasure.

Throughout the entire trip, special attention was directed to the study of daylilies (*Hemerocallis*). They were observed at the establishment of Vilmorin-Andrieux et Cie near Paris; at the garden maintained by Willy Müller in Naples, where several hybrid daylilies have been produced; in the collections of living plants at the Royal Botanical Garden in Munich; at the garden of Mr. George Yeld, who was a pioneer in the breeding of daylilies; in

the nursery of Mr. Amos Perry at Enfield, where several hybrid clons have originated; in the very complete collection maintained at Wisley in the gardens of the Royal Horticultural Society; and at the Royal Botanic Gardens at Kew, where both living plants and herbarium material of various type specimens were studied. As a result much was learned that will be of value to me in further study and work with this genus.

The opportunity to observe poplars in Europe was rather fully utilized as to studies of the types grown, the purposes for which they are grown, prevalence of diseases, and methods and results of forestation efforts with poplars. A special report on these studies is contemplated.

Observations were made which clearly indicate that the virus diseases of lilies (*Lilium*) are present in England, and have a vital relation to the culture of lilies in England, as in America.

At two different nurseries, one near London and the other near Southampton, the lilies being grown as the surplus or unsold stock of imported bulbs were badly affected with virus diseases. The species in which the symptoms of disease were most evident were *Lilium longiflorum, L. auratum, L. speciosum,* and *L. superbum.* Various stages in the development of the disease were to be seen, from the effects of recent infection to the final stages of death in a plant. Presumably the virus was present in certain of the bulbs when they were obtained by the nurserymen; also the disease was spreading to plants previously healthy.

Later, in company with Mr. A. Grove, author of a volume on "Lilies" and an authority on garden lilies in England, Dr. Lawrence Ogilvie, formerly plant pathologist of Bermuda, and Dr. H. S. Cunningham, who is at present plant pathologist of Bermuda, the writer inspected greenhouses near London in which lilies are forced in large numbers for the cut-flower market; also a visit was made to the Royal Botanic Gardens at Kew to see the plants of *Lilium auratum* being grown for display. In the greenhouses the stock of *L. auratum* then in good foliage was badly diseased. In two houses filled with *L. longiflorum giganteum,* about 75 per cent. of the plants were in the advanced stages of the two virus diseases known as "yellow flat" and as "mosaic," both of which were especially studied by Dr. Ogilvie in Bermuda. In certain

greenhouses, however, the precentage of plants with virus diseases was low; but some diseased plants were to be found scattered through the houses. These plants were being grown from bulbs obtained directly from the Orient, and were blooming for the first time in England. The practice in the commercial forcing of lilies in England, as in America, is to use bulbs for one crop only, after which the bulbs are discarded. But even in such cases, the presence of virus diseases in as much as 25 per cent. of the bulbs results in considerable loss to the grower.

In the various garden plantings of *Lilium auratum* in the Royal Botanic Gardens at Kew, mosaic was abundant and in various stages of its effects; mottling of leaves was very pronounced; the dwarfing and stunting effects were frequent and obvious; and also plants were in the last stages of disease and approaching death. Dr. Ogilvie found present the species of *Aphis* which is known to transmit the virus of lily disease; and there was evidence, in the symptoms observed, that the disease was being spread from diseased plants to plants formerly healthy. Plants that were entirely free from disease were in the minority; but these were, in most cases, excellent plants of vigorous growth, good blooming, and fine appearance, indicating what plants of this species can do in England when they are free of disease. At the time of these observations (in August), the season was too far advanced for satisfactory observations on the conditions of disease in the various narrow-leaved lilies; and no special study of them was attempted. It should be stated that many fine lilies were seen at the Royal Botanic Gardens, at the gardens of the Royal Horticultural Society at Wisley, and at Wymans in Sussex, the estate of Lieutenant-Colonel L. C. R. Messel. Many of these plants have been grown from seed.

At various gardens, striking cases of complete unfruitfulness in plants were observed which were clearly due to the isolation of a single individual which possessed some type of sterility that made cross-pollination necessary for fruit production and to the propagation of a clon from such a plant. Thus, at the garden of Willy Müller in Naples, a splendid vine of *Bignonia Kerere,* planted in 1857 and now growing over the walls to the top of a six-story building, has bloomed freely for many years, but has never

borne fruit. At the Royal Botanic Gardens at Kew, the plants of *Hidalgoa Wercklei* (the Climbing Dahlia), of *Abutilon vexillarium*, and of *Petunia integrifolia* are all self-fruitless. The species last named is of special interest, for it was lost to cultivation for many years until 1916, when seeds of it were obtained from the wild in South America. But, evidently, the subsequent propagations were from one single seedling which was fully self-incompatible; hence, all the plants at Kew now set no fruit to any kind of pollination amongst them. These and other cases were of special interest in connection with my own studies of sterilities.

The above brief summary necessarily omits mention of numerous botanical institutions which were visited, of many observations of interest and value that were made, and of many persons who showed special courtesies to the writer, all of which are appreciated and cherished in personal remembrance.

A. B. STOUT,
Director of the Laboratories.

REPORT ON BOTANICAL STUDY IN EUROPE, 1930

With the permission of the Scientific Directors, I sailed from New York April 19 for five months of botanical study in Europe. The prime motive for the journey was the necessity of comparing numerous specimens recently received by us from Venezuela and Peru with the types, which are chiefly deposited in European herbaria. The second reason was the Fifth International Botanical Congress, held in England in August, before which I had been invited to present a paper. Approximately two months were spent in Berlin, at the great herbarium of the Botanical Museum, two months in England, mostly at the herbarium of the Royal Botanic Gardens at Kew, and one month at the Conservatoire Botanique in Geneva. At each of these institutions I was most cordially received and given every possible facility for my work. To the officers in charge, Dr. L. Diels, Dr. John Briquet, and Dr. Arthur W. Hill, I extend my sincere thanks for hospitality and scientific courtesies, and I am scarcely less indebted to the numerous learned botanists who compose their staffs. A shorter time was spent at the Herbarium Boissier, in the University at Geneva, and I wish

to record my appreciation of the assistance given me there by Dr. Gustave Beauverd.

Our assistant curator, Mr. Albert C. Smith, had only recently returned from an extensive collecting trip through Peru and parts of northern Brazil; and my visit at Berlin was invaluable in identifying some of the rich collection which he brought back. Berlin has by far the largest set of the great Peruvian collections made by Weberbauer in the mountains of Peru; there are to be found also the best set of the Ule collections from the upper Amazon and its tributaries, the only plants of Tessmann from the same region, in any available place, and a large set of the old collections of Poeppig. These various collections include hundreds of types. Another early collector in the same region was Spruce, who first brought an extraordinary number of species to the attention of botanists; the best display of his plants is located at Kew. At the same herbarium may be found the best set of Peruvian plants by Mathews, another early collector. I was accordingly able, in one institution or the other, to match our own collections against authentic material of almost all species known from the region, to settle the identity of most of them, and to determine beyond doubt that numerous others represent species hitherto undescribed. The further study and publication of names for these new species will occupy a considerable part of my time during the coming winter.

The large collection at Geneva, formed by the recent amalgamation of two distinct herbaria, is particularly rich in certain collections not often seen in herbaria, including those of Funck, Schlim, and Linden from Colombia and Venezuela. All of these collected extensively in northeastern Colombia, the scene of recent exploration by Mr. E. P. Killip and Mr. Albert C. Smith; here again I was able to identify a considerable number of our own plants.

A third group of plants in which I was interested was the Tate collection from the Rio Negro and from Mount Duida. The former were collected in the same general region, and often at the precise localities where Spruce collected seventy-five years ago, and most of our collections were named at once by comparison with the Spruce material. The plants from the summit of Mount Duida, on the other hand, are largely endemic and undescribed;

and it was accordingly impossible to match them in any of the herbaria which I visited. It was necessary, however, to be assured that they were actually new species, which involved careful search in all three institutions through the material from the Andes, Venezuela, and even southern Brazil. A minority of the plants were identified in this way; but most of them await further study and description.

The International Botanical Congress at Cambridge, which was attended also by four of my colleagues, was a success in every way. Besides the scientific papers which were presented, and the botanical business which was transacted, each of us was able to make new acquaintances, and to establish contacts which will certainly prove valuable to the future progress of our research work.

A few words may be permitted concerning the three institutions which I visited. The botanical garden at Berlin, like our own, is relatively young, but contains a vast assemblage of species from all parts of the world. The arrangement of the plants is geographic rather than systematic. The visitor walks through a section devoted to eastern America, where all the plants look familiar, passes on to others representing the plants of Japan or central Europe, climbs the artificial hills displaying the flora of the Alps, and finds an excellent collection of tropical plants under glass. Dr. Engler, to whom the progress of the garden is largely due, has now retired, but his work is ably continued by Dr. Diels. The Conservatoire at Geneva occupies a wonderfully beautiful site on a hillside on the shore of Lake Geneva, and a single, plain but efficient building houses a herbarium considerably larger than our own. From the windows of the visitors' room one looks out across the blue waters of the lake to range after range of the Alps, rising higher and higher in the distance and culminating in the background in the snowy peak of Mont Blanc. I doubt if any other botanical institution in the world can boast of so magnificent a setting. The famous botanical garden at Kew, with its great expanses of velvety lawn, its wealth of shrubbery, its fine trees, its floral displays, and its great glasshouses, continues to be the pride of London and the envy of all botanical visitors, while its enormous herbarium and library keeps it in the lead among institutions carrying on taxonomic work.

H. A. Gleason.

UNUSUAL PLANT OCCURRENCES AROUND NEW YORK[1]

The exceptional plant occurrences here noted, in the local flora range covered by the Torrey Botanical Club, within about one hundred miles of New York City, including all of New Jersey and Connecticut, Long Island, the lower Hudson Valley as far north as Columbia and Greene counties, the Catskill region to Delaware County, and several eastern Pennsylvania counties, appear to be due to general or special effects of the most important recent geological factor governing vegetation in the northeastern United States—the continental ice-sheets of the last Glacial Period.

Some of them are survivals of Canadian, Hudsonian, or even subarctic species, or of such as have ranges extending far north, where they are more common. They are now islanded on high bleak places, or isolated in cold bogs above 1000 feet or more. They are not spreading and in some cases appear to be decreasing, and, where affected by other causes, such as fires, or the works of man, succumb to such effects without much effort at survival.

A rarer example of plant distribution, due to the effects of the continental glaciers, is the existence of small colonies of plants on boulders transported south by the ice sheets from regions where such plants are normally found.

Another effect, due to the change in the climate after the disappearance of the ice sheets, is the apparent infiltration of pioneer stands of species commonly found southward and now advanced into the area north of the terminal moraines, and, in some cases, into habitats strikingly different from those where such species are ordinarily seen.

The vegetation in general, in this area, has become established in zones governed by soil, moisture, elevation, and other causes, in the period of at least twenty thousand years since the last retreat of the ice. There are four principal, rather well-defined zones, although there is some merging of species. These are: the marsh-grass zone along the New Jersey and Long Island shores; the oak-pine belt of the New Jersey Pine Barrens, with somewhat similar areas on Long Island; the chestnut, oak, yellow poplar

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, September 13, 1930.

(tulip-tree) belt in northern New Jersey, on the north shore of Long Island, in most of Connecticut, and in the Hudson Valley south of the Catskills, in which an alteration is occurring, owing to man's carelessness, in the death of the chestnut from an imported Asiatic fungus blight; and the birch-beech-maple-hemlock association, in the Catskills, northeastern Pennsylvania and northeastern Connecticut. A fifth zone, the spruce-fir northern coniferous forest, is represented on the summits of the higher Catskills, from 3500 to 4200 feet above sea-level.

Hemlock, which was formerly more common in the chestnut, chestnut-oak, yellow poplar zone, is returning to it since the cessation of regular cuttings for tanbark, cordwood, and charcoal, and the establishment of large public parks and forests. Additions to the percentage of coniferous trees are being made by artificial plantings of white and red pines.

These zones are generally so well fixed that the occurrence of plants which appear to be laggards from the northward retreat of species which are happiest in a colder climate than that of the Middle Atlantic States, or pioneers in later waves of migrations from the south, attracts the speculative interest of the field student as to the reasons for their presence in this area.

To cite first examples of the rear guard units of the northward movement that followed the melting of the ice, which appeal to our sympathy as surviving relicts of bleak conditions which pleased them better, one of the most interesting in our area is the Three-toothed Cinquefoil, *Sibbaldiopsis* (*Potentilla*) *tridentata,* found on the shores of Greenland and Labrador, at moderate elevations in northern New England and the Adirondacks, but with us only in a few high places. Only about half a dozen occurrences are recorded within the range of the Torrey Botanical Club, on Bear Mountain, 2350 feet; and Brace Mountain, 2250 feet, on the Taconic plateau in northwestern Connecticut; on Overlook Mountain, 3000 feet, on the eastern front of the Catskills; on Mount Beacon, 1640 feet, at the northern front of the Hudson Highlands; on High Point, 1807 feet, in northwestern New Jersey, the highest summit of Kittatinny Mountain; and on high summits in Luzerne County, in northeastern Pennsylvania. These are all open bleak spots, where the conditions are similar to

those in which the plant is common and happy, farther north, on the above-timber line areas in the Adirondacks, Green Mountains, and White Mountains.

South of our area, this plant is found on high peaks of the Appalachians, in Virginia and North Carolina, from 4000 to 5800 feet. Evidently this cinquefoil retreated up to such bleak spots when the climate warmed after the end of the last glacial advance, and is now islanded on them, and probably faces extinction from the inevitable invasion of lowland species, if, as seems probable, we are still on the swing back from the Ice Age.

A companion plant of Sibbaldiopsis, *Arenaria groenlandica,* the Mountain Sandwort, on Adirondack and New England summits and at lower levels farther north, is still rarer in our area, reported some years ago on high Catskill summits, but now absent from at least twenty of the highest which I have visited; but it occurs on high summits in Monroe County, Pennsylvania. It does occur just outside our area, on Mount Everett, at 2650 feet, over the Massachusetts line, on the Taconic plateau, and on Alander Mountain, 2300 feet, on the New York-Massachusetts line, in the same vicinity. It is another islanded northern species, probably fated to disappear in such precarious positions.

Among plants which are Canadian or Hudsonian, with ranges to Alaska and the Hudson Bay region, which persist in high cold places in our area, is the Bunchberry, *Cornus canadensis,* common in northern New England, in the Adirondacks above 1000 feet, and on the higher Catskill summits. I know of four stands: one on Schunemunk Mountain, in Orange County, New York, at 1600 feet, and three on Kittatinny Mountain, in northwestern New Jersey, one at High Point, at about 1650 feet, another west of Culver Lake, at 1400 feet, both in Sussex County, and another, which I found in August, west of Branchville, at 1500 feet, in Warren County, the first report of the plant in that county. None of these colonies seems happy; they flower only scantily and do not fruit at all; they persist apparently by vegetative extension by stolons.

Among the trees, there are two northern species which appear to find their southernmost limits in our area at elevations below 2000 feet. These are the Red Spruce, *Picea rubens,* and the

American Larch, *Larix americana*. Both occur in a few limited stands at Spruce Pond, in the Harriman State Park, at 1000 feet; in high wet woods about Greenwood Lake, in Orange County, New York, in Passaic County, New Jersey, at 1000 to 1200 feet; on Kittatinny Mountain, at High Point, 1650 feet; and farther south in two or three places at 1400 to 1600 feet. Another northern conifer, the Northern White Cedar, or Arbor-vitae, *Thuja occidentalis*, is found, with some of the Red Spruce stands noted, about Greenwood Lake and on High Point, and was formerly reported farther south along the Kittatinny ridge. It becomes more numerous in northern Orange County and in Dutchess County; and occurs in northwestern Litchfield County on the Taconic plateau.

Examples of plants in abnormal situations, due to the effects of the transportation of material by the continental glaciers from north to south, are two colonies of the Walking Fern, *Camptosorus rhizophyllus*, growing on boulders of the Wallkill Valley limestone deposited by the melting ice on the older granites of the New Jersey and Hudson Highlands. One such boulder is near Wawayanda Lake, in Sussex County, N. J.; another near Upper Cohasset Lake, in the Harriman State Park, in Orange County, N. Y.; each from ten to thirty miles from its source. Another limestone boulder which bore such a Walking Fern colony, established on a suitable medium perhaps by birds carrying the spores, is now buried under the waters of the Wanaque Reservoir, in Passaic County, N. J. Walking Fern is common on the Wallkill and Kittatinny Valley limestones, whence these boulders were transported, but absent in the older rocks about their present locations.

Two interesting examples of southern plants which apparently followed up the retreat of the ice in the competition for the land cleared by its melting are the Southern White Cedar, *Chamaecyparis thyoides*, and the Prickly-pear Cactus, *Opuntia vulgaris*. They are found along the coast to Cape Cod, where they migrated perhaps before the ice left the northeastern area of the United States, along the then unsubmerged continental shelf. But each has sent advanced units fifty to seventy miles inland, the cactus up the Hudson River as far as Constitution Island, opposite West

Point, and the cedar into the New Jersey Highlands, about Greenwood Lake at 1200 feet, and on High Point, New Jersey, at 1650 feet. In some high swamps, both *Chamaecyparis* and *Thuja* grow together, a curious mingling of northern and southern types. The Southern White Cedar appears quite as happy, except for cutting by man, as in its typical stands along the New Jersey Pine Barren streams. But the Cactus, *Opuntia,* is decidedly not happy, and is perhaps fated to disappear in its apparently unsuitable locations in the midst of deciduous hardwoods. It is thought to have advanced north in a semi-arid climate following the last glacial retreat, and to have established itself in sandy places like south Jersey, southern Long Island, Martha's Vineyard, Nantucket, and Cape Cod, where it seems likely to persist, and also to have sent pioneer units into the highlands in northern New Jersey and southern New York. It is still found on trap rock ridges north of Paterson, N. J., and west of Haverstraw, N. Y.; and on granite hills west of Midvale, N. J., and on granite on Bear Mountain, and on the knobs in the marsh back of Iona Island, N. Y. But with an increasingly moist climate, and thickening of the stand of deciduous hardwoods about it, it seems likely to be overshaded into extinction, and, in such localities, it flowers and fruits only sparingly, and is having a hard time to survive. Its advance into the hardwood zones in the highlands seems to have been a piece of over-enthusiastic pioneering which is not destined to give it permanence, although it should long persist in the dry, sandy areas along the coast.

These are outstanding examples of unusual occurrences of plants in our area, due to the adjustments of vegetation following the melting of the last ice sheet. These adjustments are still going on, as the climate appears to be still warming, and they suggest that these northern, subarctic, now locally subalpine, plants are threatened with extinction by the invasion of their positions by species fitted for more moderate conditions.

RAYMOND H. TORREY.

HARVESTING IRIS SEEDS IN THE GULF STATES

Observations among the irises of the Gulf States for several successive flowering seasons aroused a desire to visit the same fields during the fruiting season. In order to add to our study of these irises we devoted about two weeks of last July and August to making a collection of iris seeds, perhaps the largest collection, as far as the great variety of species and forms is concerned, ever made in a limited area.

In peninsular Florida, as a result of an early flowering season the fruits of *Iris savannarum* and *I. Albispiritus* had already matured, and the unusually heavy summer rains had flooded these iris habitats and floated their seeds away to their destinies.

In northeastern Florida we had the coöperation of H. Harold Hume, who has been observing the iris localities in that region for several years. Here we secured the remnants of the fruits of the early flowering species *-Iris carolina* and of *I. savannarum*, the stalks of both usually standing in water two feet deep. Here many of the pods had begun to decay, each producing a gob of clear jelly formed about the decaying walls where the seeds emerge. The late-flowering species, *Iris hexagona,* was just maturing the seeds of a crop for some reason rather limited.

Having secured the seeds that were available in northeastern Florida, we started westward. For some recondite reason there appears to be little or no iris in the northern tiers of Florida counties between the big bend of the St. Mary's River and the Ocklockonee River, and also on through the corresponding latitude of Alabama and Mississippi to and beyond the Pearl River.

Instead of going directly across the state, we went down into the delta of the Apalachicola River. There three distinct types of the genus iris occur. The Versicolor group is represented by striking forms of the wide-spread *Iris carolina,* the Savannarum group by the much geographically restricted *Iris Kimballiae,* and the Tripetala group by *Iris tripetala.* The two first-mentioned species are early-flowering ones. Only a scant supply of their seeds was secured. However, ripe perfect capsules of *Iris Kimballiae* were collected for the first time. The plants of *Iris tripetala,* a late-flowering species, were just maturing their fruits. Apparently few seeds of this unique species were heretofore col-

FIGURE 1. On the edge of the Caloosahatchee prairies, Florida. *Iris savannarum* shown, as it frequently covers large areas of low prairie. Florida's surface supports seven species of *Iris*. The one here shown is the most abundant and largest-flowered species in the state. Such areas produce vast quantities of seeds.

lected. In Florida it grows in the flatwoods and along streams that wander through the flatwoods, whereas the two other species just mentioned are hammock plants. *Iris tripetala* does not fruit freely every season, but this season thousands of pods could be harvested in a short time.

After the delta of the Apalachicola River, we came to a series of estuaries, for example, those of the Escambia River, the Mobile River, the Pascagoula River, and Bay St. Louis. In the vicinity of all of these are irises; *Iris carolina,* at least, was in evidence and furnished seeds for our studies. However, the shores of the Mobile River furnished a forerunner of what we were to meet in the Mississippi Delta—a large "blue" iris related to the dominant species of *Iris* of southern Louisiana.

The metropolitan district of New Orleans, in the midst of the great iris development, was the center of our most extensive collecting activities.

The southern Louisiana irises have a number of peculiarities, some of which will be mentioned on following pages. One which makes the collecting of iris seeds somewhat difficult is the peculiar habit the plants have of dispensing with their aërial parts in the summer. However, our knowledge of definite colonies throughout the region enabled us to secure a fair collection of seeds. In passing, it may be of interest to record that in a number of localities always exposed to the full sun, where in the spring we found large colonies of iris with hundreds of showy flowers, in the summer not a spent leaf or a flower stalk could be found. We were so surprised that we could scarcely believe it was the identical spot we saw in the spring. In order to make sure we asked natives living close by. They replied that the "potatoes" (referring to the rootstocks) were in the ground and that there would be plenty of "lilies" (as the iris flowers are known locally) in the spring.

There was another locality near Lake Pontchartrain from which we particularly wanted a supply of seeds. In the spring, in an open meadow-like spot, there are thousands of plants of a large "blue" iris. In summer this spot is completely covered by ragweed (*Ambrosia aptera*) growing eight to twelve feet tall. In order to get the seed we began by cutting trails with machettes through the ragweed in the direction of the large iris patches, and

then mowing down small areas of ragweed. The first attempt failed of results; a second search on another day was made by cutting more trails and more areas, and yet without success. On a third day another unsuccessful attempt to find this iris was made. Although we had by this time cleared the spots where the iris grew and beyond them, not a leaf or stalk was found. The only rewards for our labors were the meeting, head on, of a fine specimen of a timber or cane rattlesnake, and blistered hands.

The paucity of seeds in some localities was to be accounted for by the activity of rats, rabbits, and other animals.

Collecting conditions were quite different from those that obtained in the spring. A long drought had lowered the water-table. Localities where we had collected iris in water knee-deep and waist deep were now actually dusty.

This rather unusual condition had a decided effect on the ripening of the iris pods. In the marshes and on the prairies that had become unusually dry the pods were found to be fully ripe, in some cases actually spent. In damp ditches and along bayous the pods were often just maturing or even green.

Our activities were confined for the most part to a region south of the latitude of Lake Pontchartrain, along the eastern bank of the Mississippi as far south as Bohemia along the river, and east of Côte Blanche and Jeanerette.

Two special objects prompted the making of this iris-seed collection: the one, general plantations of iris seedlings in order to see in a gross way what progeny may result, the other and a more special object, also concerning the progeny, being the establishment of four plantations in different latitudes, from the complete contents (seeds) of the pods of individual plants or distinct colonies. In this way we may be able to see, to a certain extent, how active the bees have been in making natural hybrids between the various species of *Iris* in that region.

Experiments from several standpoints are now underway; for example: the hardiness of the plants in northern latitudes and various longitudes far removed from those of their nativity; their resistance to cold and freezing; their adaptability to soils other than those of their natural habitats; their reaction to dry situations as contrasted with their natural wet haunts.

This extraordinary development, discovered a half decade ago and referred to in recent publications,[1] has suggested various and interesting problems.

As has already been recorded, in some of the articles referred to in the preceding footnote, no satisfactory explanation for the existence of these lower Mississippi Delta iris fields and their constituents has yet been suggested.

However, the habitat of these multitudinous iris species and forms is interesting, and is, in part, accountable for their existence. This habitat superficially, at least, is geologically recent. The soil in which the irises grow consists of the alluvium brought from all the different kinds of soils through which flows the longest river of the world and its great and small tributaries plus the decayed vegetable and animal remains of their waters, the refuse of the many settlements along their courses and the fertilizers from myriad farms, draining into countless streams. This deposit, rich in plant food, increasing periodically, forms a gumbo in which thrives both native and exotic vegetation.

Two theories to account for the presence of this concentrated iris growth may be mentioned: I. It may represent the remains of a vast development of the genus in the more recent geologic times that followed the gradual southward advance of the Mississippi Delta from the interior, most of the species having become extinct in the rear for certain reasons as the advance continued toward the Gulf of Mexico. II. On the other hand, it may represent the progeny of a local development, *in situ,* whose basis was a few irises, some derived from the upper part of the Mississippi watershed, others from the eastern Gulf region. These having met and mingled in this favorable environment produced according to their various methods what we find today.

Among the many interesting facts exhibited by the local distribution of the southern Louisiana irises may be mentioned maximum development, which seems dependent on three factors. It occurs: I, along the main outlets of the Mississippi's waters—the Mississippi proper, the Atchafalaya River, and the larger bayous between and flanking these main outlets west as far as Vermilion Bay and east to Pearl River; II, in the most recent deposits of the

[1] Addisonia **12**: 1, 2; **14**: 1, 2, 5–14; Jour. N. Y. Bot. Gard. **31**: 40–45; 31.

specialized soil referred to above (which is soil that has been recently and is now being added to the superficial layer, by the minor annual or seasonal floods and the major floods which submerge the region when the solid content of the waters is maximum); III, in a rather restricted area south of the latitude of Lake Pontchartrain north of the area which is covered at irregular periods with salt-water blown inland from the Gulf by storms. In other words this iris is quite daring. It will not tolerate salt-water but it often makes its greatest developments and showiest fields as close to saline influences as it can get without actually entering the salt-marshes.

JOHN K. SMALL.

EXPRESSION OF APPRECIATION OF SERVICES OF DR. AND MRS. BRITTON BY THE INTER-AMERICAN CONFERENCE ON AGRICULTURE, FORESTRY, AND ANIMAL INDUSTRY

Washington, D. C.

Secretariat:
Pan-American Union,
October 6, 1930.

Dr. Nathaniel Lord Britton,
The New York Botanical Garden,
New York City.
Dear Sir:

I take pleasure in enclosing herewith an official copy of a resolution adopted on September 19, 1930, by the Inter-American Conference on Agriculture.

Very truly yours,

LEON M. ESTABROOK,
Secretary General.

THE INTER-AMERICAN CONFERENCE ON AGRICULTURE,

Considering with a deep sense of appreciation and fully recognizing the valuable services contributed by Dr. and Mrs. Nathaniel Lord Britton, retired director and bryologist, respectively, of The New York Botanical Garden, as ex-

plorers and distinguished students of the West Indian native flora and their inspiration and leadership in the research problems of the tropics,

RESOLVES:

To record in the minutes of this Conference a recognition of their important services and that a copy of this resolution be sent to The New York Botanical Garden.

(*Approved September 19, 1930.*)

A true copy:

LEON M. ESTABROOK,
Secretary General.

MACDOUGAL'S THE GREEN LEAF[1]

In this attractive little book of 142 pages, the author tells an interesting and readable story of food manufacture by plants in their green leaves—a process as indispensable to man and all other life on earth as it is to the plant. In plain, clear, and simple phrases he explains the complex processes and the structures in which they are performed. First he discusses the grass leaf, the food purveyor for man and most of his domestic flocks and herds; then the pine leaf, supreme builder of wood; the oak leaf and the cactus trunk. His accounts of the physical and physiological processes are full and excellent, and enforced by such graphic comparisons to factories, rooms, and buildings as to make the whole story read like a fairy tale. For instance, in describing the structure of the leaf he supposes it to be magnified 150,000 times, and conducts a tour of investigation through this food factory, describing the conditions there at different times of day.

FORMAN T. MCLEAN.

[1] MacDougal, D. T. The Green Leaf. Pp. 1–142. f. 1–22. D. Appleton & Co., New York. 1930. $2.00.

NOTES, NEWS, AND COMMENT

Eight fellowships for the training of leaders in forestry have been awarded for the year 1930–31 by the Charles Lathrop Pack Forest Education Board, and the Board is preparing to receive applications for fellowships for the year 1931–1932. The fellowships already granted cover a wide range of practical and theoretical forestry, including reforestation, management of private forest estates, coöperative marketing of forest products, silvicultural management, and forest pathology. Six to eight fellowships, with stipends ranging from $500 to $2,500, are available for the coming year. The purpose of the fellowships is to encourage men who have shown unusual intellectual and personal qualities to obtain training that will best equip them for responsible work, either in the general practice of forestry, in the forest industries, in the teaching of forestry, in forest research, or in the development of public forest policy.

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The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
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JOURNAL
OF
THE NEW YORK BOTANICAL GARDEN

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A. B. STOUT

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ARTHUR HOLLICK

PUBLIC LECTURES DURING THE WINTER OF 1930-31

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JOHN R. BRINLEY, C. E. ..... *Landscape Engineer*
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FORESTATION WITH POPLARS IN FRANCE

In various areas in France, poplars (*Populus*) are rather extensively planted as a tree crop for the production of timber from which lumber is made. During the past summer the writer had the opportunity to inspect such plantings, and to make observations on the kinds of poplars planted, the methods of silviculture used, and the results attained.

The observations mentioned above were made in the region about Noyon to the northwest of Paris and over a considerable area along the Ourcq and the Marne rivers to the northeast of Paris. The excursions were arranged by Dr. J. Dufrenoy, of the Station Centrale de Pathologie Végétale at Versailles. In the excursion about Noyon the party consisted of Dr. Dufrenoy and his colleague M. Diehl, Dr. Regnier, M. Granthomme, Dr. Richard White, of the Agricultural Experiment Station of New Jersey, and the writer. M. Granthomme is a consulting forester specializing on the culture of poplars, with headquarters at Noyon; under his guidance nurseries were visited, numerous plantings of poplars were inspected, and a sawmill in operation was observed. The excursion along the river Marne was made from Paris by auto provided by the courtesy of M. Auguste Collin, Président du Groupement Général du Commerce & de l'Industrie du Bois en France. Under the guidance of M. Collin, Dr. Dufrenoy, Dr. White and the author visited a large sawmill which was in operation, a nursery for the propagation of poplars, and numerous plantings in various stages of growth. The courtesies and assistance of Dr. Dufrenoy, M. Granthomme, and M. Collin made it possible to observe many, if not all, of the stages of forestation work with poplars as conducted in France. To Dr. White the author is indebted for the pictures which illustrate this article.

FIGURE 1. An excellent planting 16 years old of the "Peuplier Régénéré" at Lizy-sur-Ourcq in France.

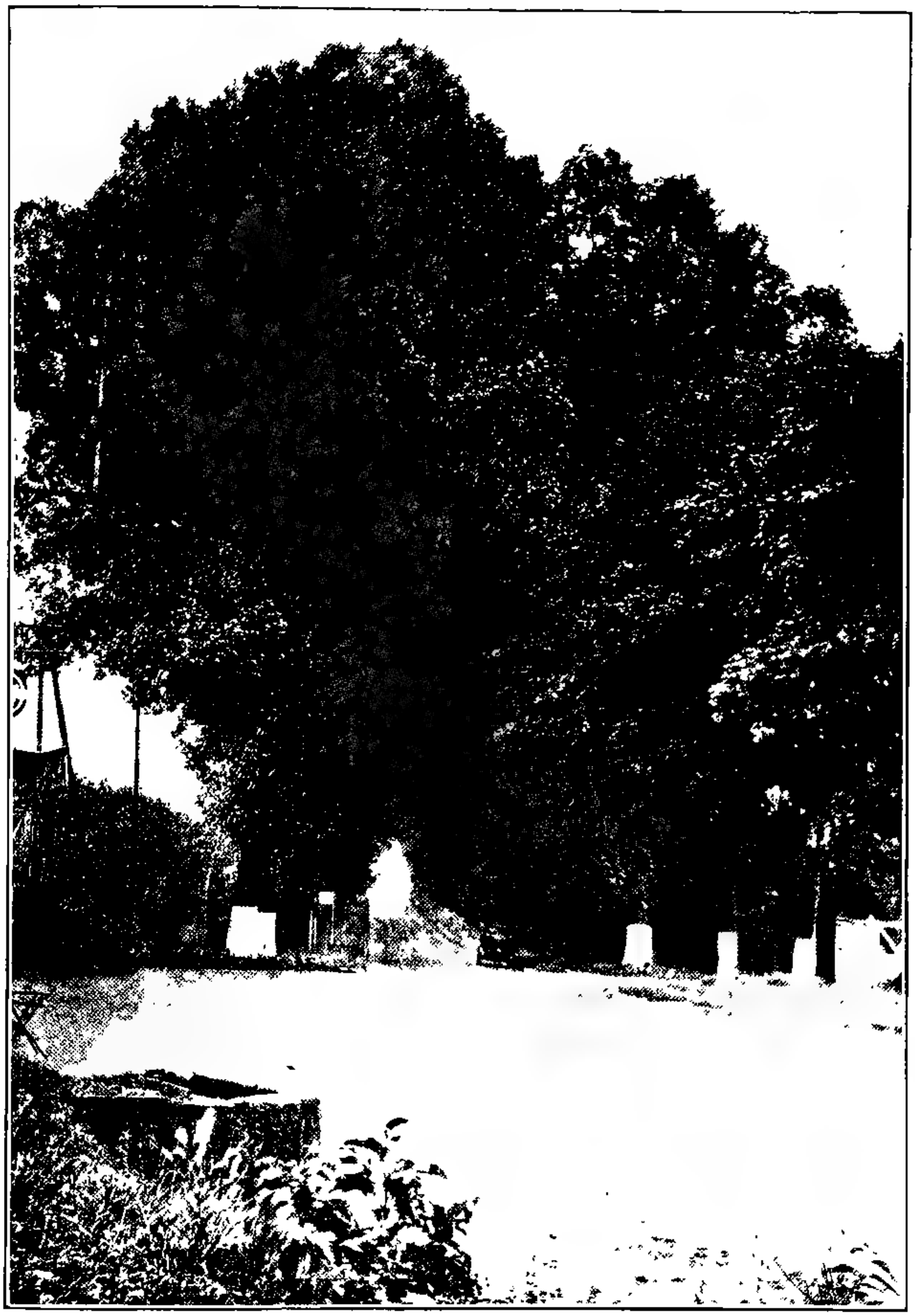

FIGURE 2. Roadside trees of "*Populus canadensis*" at Claye, France.

The principal poplars grown in France for their timber are evidently of three types, known as "Régénéré," "Angulata," and "Peuplier à Écorce Noire" (also called "Peuplier de Caroline"). In the nursery of M. Ed. Maillot-Guerin near Noyon, a poplar, which is evidently the Balm-of-Gilead, was also being propagated in limited numbers under the name Japanese poplar. At the nursery of M. Guichard at Lizy-sur-Ourcq, clons known as "Gris Caroline," "Blanc Caroline," and "Robusta" were being propagated; the last, however, was a recent addition for trial in the nursery and has not yet been used in the forestation plantings. There were also in various plantations trees of the so-called *"P. canadensis,"* and what is apparently the *"Populus serotina,"* commonly called the black Italian poplar and the Peuplier Suisse, which is an old hybrid widely grown in Europe. In some instances trees were observed that resemble the *"Populus Eugenei,"* a type that is widely planted as a street tree in the United States. All of these poplars show decided resemblance to the wild necklace poplar of northeastern United States and they have evidently been derived either directly or by hybridization from this species. In various plantings observed there is obviously a mixture of two or more types or clons, the exact identity of which is difficult to determine.

In making forestation plantings in France, the rule is to use three-year-old trees that have been grown from cuttings in nursery culture. The trees are frequently nine feet tall when planted and they make very little growth the first year after the transplanting. It is said that younger trees or cuttings do not succeed.

The most extensive plantings are in lowlands that are unsuited to agriculture. As one travels on the highways of the higher land overlooking the valleys, hundreds, and perhaps even thousands, of acres of splendid poplar trees may be seen. Many trees are also planted in long rows along the roadsides and these contribute a picturesque feature to the landscape, especially when the branches are removed except for a tufted crown at the top.

In the block plantings of the lowlands the trees are usually placed in rows that are nine meters apart with trees spaced five meters apart in each row, which allows about 100 trees to the acre. In nearly all cases the trees are planted in grasslands and the grass is usually mowed each year, especially during the early

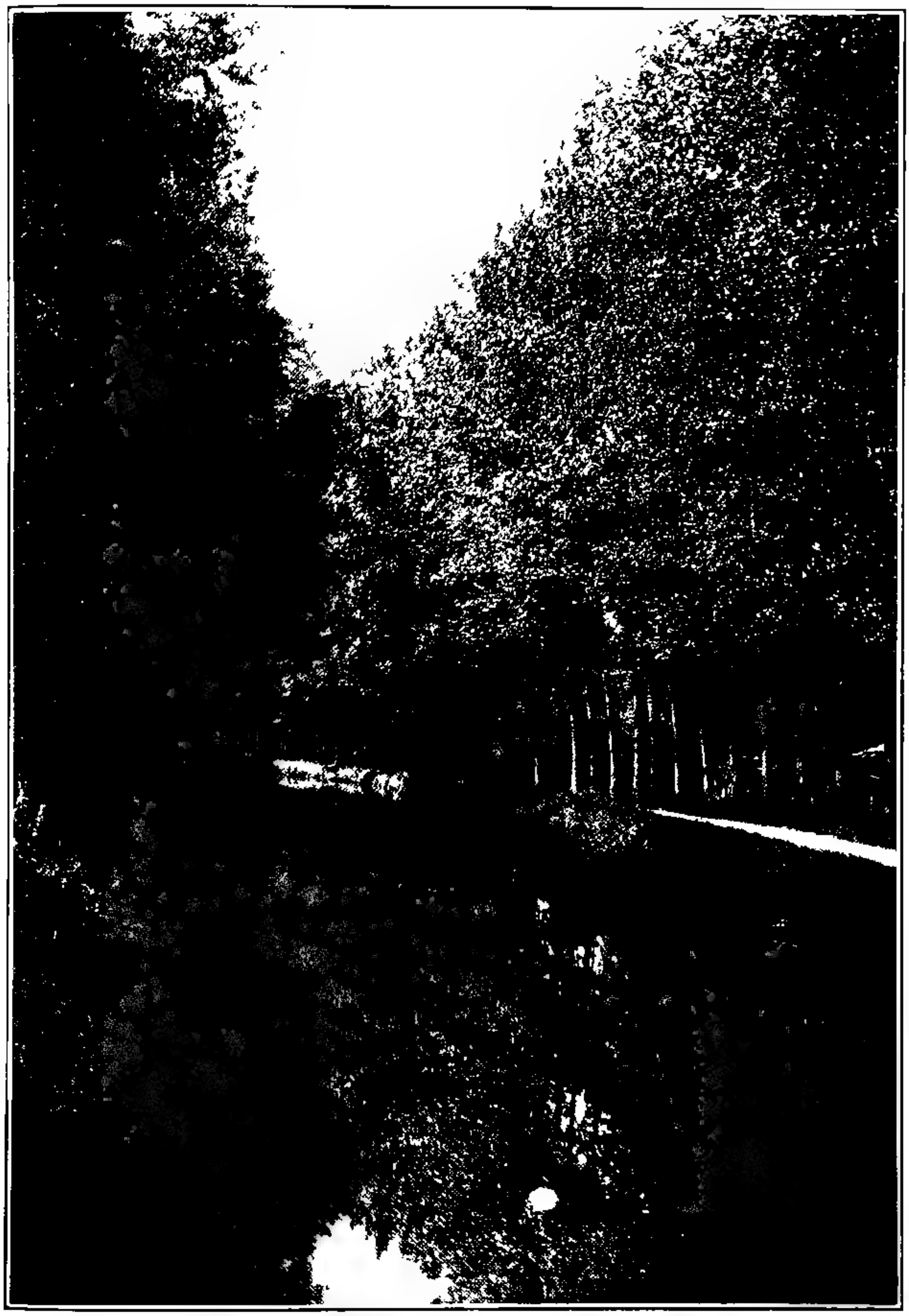

FIGURE 3. Showing the edge of an extensive planting of poplars at Crouy, France.

years of the plantation. From estimates of yield supplied to the writer, it appears that a tree crop is frequently harvested at the age of about 25 years, at which time a yield of forty or even fifty cords per acre may be obtained.

The various illustrations accompanying this article are typical of the excellent growth made by poplar trees in the plantings observed in France. FIGURE 1 shows a fine plantation at Lizy-sur-Ourcq between the Ourcq and the Marne rivers. M. Collin reported this planting to be 16 years old and to be of the type known as "Régénéré." The best trees were about 20 inches in diameter at breast height, the "D. B. H." of forestry nomenclature.

The two rows of exceptionally fine trees shown in FIGURE 2 are about 40 years old, and the largest trees are 2½ feet in diameter (D. B. H.). They are at least 75 feet tall and their widely spreading branches interlock to form a canopy above the highway. These trees were identified by M. Collin as the type "*Populus canadensis.*" The view of FIGURE 3 shows poplars along a canal with piles of logs ready for the sawmill near by. In this area there are extensive plantings of mature trees.

In the sawmills which were visited, the logs are sawed into boards of short lengths, as far as the writer observed, mostly no more than ten feet in length and usually of shorter lengths. M. Collin gave the information that the very best grade of poplar lumber is used as panels in doors, in the frames of pianos, etc.; another grade is utilized in the manufacture of fine boxes, such as are used for silverware; the poorest grades are used in the construction of cheap boxes and crates for fruit, wine, etc. Thus in France many uses are found for the wood of poplars which justify the extensive plantings that exist.

The poplars in France appear to be remarkably free from fungous diseases and insect pests. In nurseries near Noyon the fungus *Taphrina aurea* was somewhat common on leaves; but it was not causing much damage. The pustules and spores of *Cytospora* (*Valsa*) were frequently seen on dead branches; but throughout the writer's entire trip only one noticeable canker was seen on the trunk of a living tree of *Populus* and that was at the R. Instituto ed Orto Botanico in Rome. In a limited area near Noyon a canker disease new to the writer was seen. The cankers are enlarged burl-like growths formed of narrow, somewhat ver-

FIGURE 4. A typical planting of poplars now about eight years old, in the vicinity of Noyon, France.

tical furrows a few inches apart; in old cankers these furrows extend almost to the center of the trunk. The edges of the furrows are of callose tissue; and frequently there is a slimy exudate. The cankers are nearly always on the main trunk. The exact cause of this disease is not known; but the matter is being investigated by Dr. Dufrenoy. It is to be hoped that, at least, the further spread of this disease will be checked. Special effort should be made to prevent the introduction of this disease into America. But, in general, the poplars observed by the writer throughout Europe are remarkably healthy and in a thriving condition. Canker diseases (*Valsa* and *Hypoxylon*) appear to be less injurious to poplars in Europe than in America. At no place was the rust (*Melampsora*) observed. It may be stated that various of these hybrid poplars which are thriving in Europe suffer severely in America from attacks of the rust.

At the present time, the forestry efforts with poplars are more extensively developed in France than in any other country. Several hybrids whose origin was accidental, or perhaps incidental to the growing of different species together, are used and these are propagated vegetatively by cuttings. The business of growing these trees as a timber crop is highly successful; and the lumber obtained is used for a wide variety of purposes.

A. B. Stout.

ONE THOUSAND MILES DOWN THE YUKON BY CANOE[1]

The trip that is the subject of today's lecture was made almost three decades ago, in connection with work of the United States Geological Survey. A problem had arisen in regard to the geologic age of certain rock exposures in the Yukon region, which was largely dependent for solution upon the correct location and identification of certain fossil plants collected there by Survey parties. This was directly in my line of work and I was detailed to go to Alaska, make my own observations and collections, and endeavor to arrive at correct conclusions. A field assistant—also

[1] Abstract of an illustrated lecture delivered at The New York Botanical Garden, Saturday afternoon, October 4, 1930.

on the staff of the Survey—and a man whom we picked up in Alaska to act as cook and general camp assistant completed our party. The narrative of the trip has not been published, although it has been described in lectures on several occasions; but a description and discussion of certain of the scientific results attained has recently been issued –about three months ago—as Professional Paper 159 of the U. S. Geological Survey, with the title "The Upper Cretaceous Floras of Alaska."

Before entering upon a description of the trip, however, I would like to recall a few well-known facts about Alaska and its great river. The area of Alaska is about 600,000 square miles, or about equal to all that portion of the United States lying east of the Mississippi River. If placed in the middle of the United States, the northern extremity of the territory, at Point Barrow, would touch the Canadian boundary of Minnesota; the southern extremity of the mainland, where it adjoins British Columbia, would touch the Atlantic coast of Georgia; and the furthest west of the Aleutian Islands would extend to the Pacific coast of southern California. The eastern boundary is the 141st meridian, west longitude, from the Arctic Ocean to the summit of Mount Saint Elias and thence southward in an irregular line, thirty miles inland from and following the sinuosities of the coast line of the mainland, to north latitude 54° 40′. The western boundary, at the extreme western end of the Aleutian Islands, is at about east longitude 173°, or about that of New Zealand, in what we regard as the "far east." This is 3,000 miles further west than San Francisco, so that in a trip from New York to the western boundary of Alaska the traveler, on arriving at San Francisco, has only completed about one-half of his westward journey.

The Yukon River—the particular topographic feature that is the subject of today's lecture—is exceeded in length by only three North American rivers the Mackenzie, the Saint Lawrence, and the Mississippi; but its volume of water, or average annual discharge, has been calculated to be equal to that of the Mississippi. It is approximately 2,000 miles in length and varies in width from 1 to 12 miles. It is navigable for light-draught steamboats up to Whitehorse, a distance of about 1,500 miles. The current varies in velocity from an average of about 3½ miles per hour to a max-

imum of about 6 miles, according to the descent and width of the channel. It is the great highway of the Territory—in summer by boats on the water, and in winter by dog sleds on the ice. But for this river the center of Alaska would probably be unexplored and unknown today, and be practically uninhabited even by the Indians, as it furnishes them not only with the means of transportation but also with fish, the staple food both for themselves and for their dogs.

Seattle was the port of departure. We arrived there May 25. The city was overflowing with people awaiting the opening of passenger traffic to Alaska. We left June 1 and steamed up the inside passage, between the coastal islands and the mainland, to Skagway, where we arrived June 5. Here we waited until news arrived that the ice was breaking up in the river and that navigation would begin on June 11. We left Skagway *via* the White Pass Railroad and arrived at Whitehorse—the head of navigation—on the same day. On the way over the pass a stop was made at the summit, where the international boundary line crosses the railroad, and the passengers engaged in a snowball fight. We left Whitehorse June 12, on the first steamboat down the river, plowed a way through the fast melting ice, and arrived at Dawson June 15. Here we disembarked, purchased an 18-foot Peterboro canoe and camp equipment and started on the voyage down the river on the same day. The weather was delightful, there were twenty hours of daylight in every twenty-four, and we drifted down the river through British territory until June 18, when we again crossed the international boundary line and arrived at Eagle City. Here we picked up our cook and on June 20 started down the river again and began the actual work of taking observations, making careful notes, and collecting specimens. Wherever rock outcrops were exposed a landing was made, the locality was thoroughly examined, and specimens were collected if wanted. The disposition of the specimens at times represented a serious problem. Fossil plants are heavy, and we frequently accumulated hundreds of pounds of them before we arrived at a trading post where they could be packed and shipped. Our total shipments amounted to just about a ton in weight. Time passed swiftly, and almost every day brought with it some new experience, interesting, amus-

ing, and occasionally otherwise. The one ever-present annoyance was the swarms of mosquitoes. Head nets and gauntlet gloves were absolutely necessary for work during the day, and mosquito-proof tents at night were necessary for sleep and, almost, for the preservation of life and sanity. On one or two occasions gnats or "midges" also added to our discomfort, as they were so small that they made their way through the interstices of the netting. Bathing was not a pleasant function, under the circumstances, except when a sandbar out in the river happened to be available for a camp site.

We passed Fort Yukon, our furthest point north, just beyond the Arctic Circle, July 2, and on July 3 we landed at Mail Cabin No. 18, a short distance above Rampart, where we remained over the 4th and abstained from work for a day in commemoration of the national holiday. These cabins, located at intervals along the river bank, represent the relay stations for the dog teams maintained by the U. S. postal service for the transportation of the mails up and down the river on sleds during the winter. In the summer the dogs are idle and a man is in charge at each cabin. They are fed once a day on dried fish, which is cooked in a large cauldron and generally mixed with flour or corn meal that has become unfit for human consumption. They are in a chronic condition of hunger and suppressed animosity against all of their kind. A fight will start upon the slightest occasion, then it becomes free for all, and when this happens the keeper takes a heavy blacksnake whip that he has ready at hand and wields it indiscriminately until the mass of fighting animals is separated into its original component individuals. We witnessed several such disturbances during our brief sojourn there.

A short distance below Rampart the river narrows and descends sharply for a distance of about a quarter of a mile. Here the current is swift and the water rough—rather a formidable-looking rapids for the occupants of a heavily laden canoe to contemplate, when the first suck of the current is felt. The passage was accomplished easily and quickly, however, and this was the only part of the river where any possible misadventure might have been apprehended.

The trip, as far as the canoe was concerned, ended at Anvik, August 12, where we enjoyed the gracious hospitality of Rev.

John W. Chapman, of Christ Church Mission, until the arrival of the steamboat that took us the rest of the way down the river to Saint Michael and thence to Nome, whence we took steamer, August 19, back to Seattle, touching at Unalaska, Aleutian Islands, on the way.

Fossil plants were collected at about seventy-five localities between Eagle City and Anvik, and subsequent critical study of the specimens served definitely to identify and locate the areas of Cretaceous and Tertiary rocks throughout the region explored.

The lecture was illustrated by means of lantern slides of maps —one showing the size of Alaska compared with that of the United States, another showing the route traversed—and others of photographs personally taken during the journey, depicting items of human as well as of scientific interest.

ARTHUR HOLLICK.

PUBLIC LECTURES DURING THE WINTER OF 1930–31

Free lectures and demonstrations will be given in the Central Display Greenhouse, Conservatory Range 2, on Saturday afternoon at 3:30 P. M., as follows:

Dec. 6. "Herbaceous Perennials," Mr. Montague Free, Horticulturist, Brooklyn Botanic Garden.

Dec. 13. "General Principles of Bulb-Growing," Mr. John F. Johnson, Head Gardener, Geo. D. Pratt Estate, Glencove, Long Island.

Dec. 20. "Pot Plants," Mr. H. W. Becker, Foreman of Greenhouses.

Jan. 10. "The Ecology Relations of Plant Communities," Dr. W. G. Waterman, Northwestern University, Evanston, Illinois.

Jan. 17. "Cold Frames and Hot Beds," Mr. Kenneth R. Boynton, Head Gardener.

Jan. 24. "Conservatory and Sun-Room Plants," Mr. T. H. Everett, Head Gardener at the Manville Estate, Pleasantville.

Jan. 31. "Pruning Shrubs," Mr. J. H. Beale, Boyce Thompson Institute, Yonkers.

Feb. 7. "Fungous Diseases and Insects," Dr. B. O. Dodge, Plant Pathologist.

Feb. 15. "Fertilizers," Dr. Forman T. McLean, Supervisor of Public Education.

Feb. 23. "Seed Beds," Mr. George Friedhof, in charge of Propagating Houses.

In connection with this series of lectures, a popular course on "How to Grow Plants" is being conducted on Saturday afternoons between two and three-thirty. This course is open to all interested in gardening who personally come to the Garden and matriculate prior to December 6. Those attending the course will also attend this public lecture series as a part of the course. The work will be primarily practical training in the operation of handling and growing plants from seed to maturity.

NOTES, NEWS, AND COMMENT

Dr. E. D. Merrill, Director-in-Chief, spoke on The New York Botanical Garden and its work at a luncheon of the Bronx Rotary Club, held at the Concourse-Plaza on November 18.

After a successful season, most of the nearly 1100 dahlia plants at The New York Botanical Garden were badly injured by frost on the morning of October 23, and the roots of all were dug on October 30. The shift of the dahlia collection to fresh ground seems to have been abundantly justified by the results.

In place of the lecture on "California Plant Life" scheduled to have been given at The New York Botanical Garden on Saturday afternoon, November 22, by Dr. E. D. Merrill, Mr. Carl Purdy, of Ukiah, California, well-known nurseryman and specialist in the culture of ornamental California plants, was engaged to speak. He gave special attention to the bulbous plants and illustrated his interesting talk with his own beautifully colored lantern-slides.

The first Monthly Conference of the Scientific Staff and Registered Students of the Garden for the autumn was held on the afternoon of November 12. At this conference there were reports from the delegates from the Garden who attended the Fifth International Botanical Congress in Cambridge, England. There were five such delegates, Director E. D. Merrill, Dr. J. H. Barnhart, Dr. B. O. Dodge, Dr. H. A. Gleason, and Dr. A. B. Stout.

Dr. B. O. Dodge, pathologist of the New York Botanical Garden, returned to New York October 13th from a trip to Europe where he has been spending the past two months. He was one of the delegates from the Garden to the Fifth International Botanical Congress which met in Cambridge. While there he took part in a symposium on "The Significance of Heterothallism and Hybridism in Fungi," presenting a paper on "The Inheritance of the Albinistic Non-conidial Characters in Interspecific Hybrids in Neurospora." The results of his work on hybridizing species of molds in the group represented by the common orange-colored mold, which sometimes gives much trouble to the baker, prove that these fungi behave much like higher plants and animals in that some of their characters are inherited strictly according to the Mendelian principles. He has developed certain albino types which are sterile as to asexual spores, and by crossing these with other species has obtained new albino bisexual or hermaphroditic types which, though they are self-fertile, can be made to hybridize with other strains. Dr. Dodge was interested to see that the varieties of dahlias most frequently grown in parks and gardens which he visited in Europe seldom showed marked symptoms of stunting or other defects thought here to be due to virus diseases. He also had an opportunity to make observations on the elm disease caused by *Graphium Ulmi*, and which is causing much damage to elms in certain regions in Europe. This disease has been reported to be present in Ohio and perhaps in one or two other states. While it may not turn out to be as serious a trouble as the chestnut blight, yet it might be well to have suspected cases examined by forest pathologists in order that infected trees may be promptly burned to prevent further spread of the disease.

Meteorology for October. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: *80° F on the 10th;* 77° on the 13th; 64° on the 26th; and 71° on the 28th. The minimum temperatures recorded were: 44° on the 1st and the 2nd; 46° on the 7th; 34½ on the 20th and *32° on the 21st and the 23rd.* The first killing frost occurred on the morning of the 23rd. The total precipitation for the month was 1.21 inches.

Meteorology for November. The total precipitation for the month was 6.02 inches. Traces of snow fell on the 25th and the 27th. The maximum temperatures for each week were *69° on the 9th,* 63° on the 13th and on the 22nd, and 57° on the 24th. The minimum temperatures for each week were *27°* on the 7th, 34° on the 11th, 37° on the 20th, and *15° on the 29th.* On the morning of the 29th a thin sheet of ice formed over the surface of the Middle Lake.

ACCESSIONS

LIBRARY ACCESSIONS DURING MAY, 1930 (CONTINUED)

STRASBURGER, EDUARD ADOLF, & OTHERS. *A text-book of botany; . . . translated from the German by H. C. Porter.* Ed. 2, *revised with the fifth German edition by W. H. Lang.* London, 1903.

TAYLOR, NORMAN. *Botany, the science of plant life.* New York, 1922.

THOMSON, SAMUEL. *A narrative of the life and medical discoveries of Samuel Thomson.* Ed. 3. Columbus, 1827.

———. *New guide to health; or botanic family physician.* Ed. 10. Columbus, 1835.

THUILLIER, JEAN LOUIS. *Flore des environs de Paris.* New ed. Paris, 1824.

THURMANN, JULES. *Abraham Gagnebin de la Ferrière.* Porrentruy, 1851.

TIFFANY, LEWIS HANFORD. *The Oedogoniaceae.* Columbus, 1930.

TOURLET, ERNEST HENRY. *Catalogue raisonné des plantes vasculaires du département d' Indre-et-Loire.* Paris, 1908.

TOUSSAINT, ANATOLE. *Étude étymologique sur les flores normande et parisienne, comprenant les noms scientifiques français et normands, des plantes indigènes et communément cultivées.* Rouen, 1906.

TOWNLEY, HOUGHTON. *English woodlands and their story.* London, 1910.

TRAILL, CATHERINE PARR (STRICKLAND). *Studies of plant life in Canada.* Ottawa, 1885.

TRIMBLE, ISAAC PIM. *A treatise on the insect enemies of fruit and fruit trees.* New York, 1865.

TROUESSART, EDOUARD LOUIS. *Les microbes, les ferments et les moisissures.* Ed. 2. Paris, 1891.

TYAS, ROBERT *Flowers and heraldry; or, floral emblems and heraldic figures.* London, 1851.

WALTON, GEORGE LINCOLN. *The flower-finder.* Philadelphia, 1914.

WARNER, HELEN GARNIE (HELEN HARCOURT, PSEUD.). *Florida fruits, and how to raise them.* Jacksonville, 1884.

WIEPKING-JÜRGENSMANN, HEINRICH FR *Garten und Haus 1. Das Haus in der Landschaft.* Berlin, 1927.

WOOLSEY, THEODORE SALISBURY. *French forests and forestry; Tunisia, Algeria, Corsica; with a translation of the Algerian code of 1903.* New York, 1917.

ZIMMERMANN, WALTER. *Die Phylogenie der Pflanzen.* Jena, 1930.

MUSEUMS AND HERBARIUM

194 specimens of flowering plants from Sao Paulo, Brazil. (Given by Dr. F. C. Hoehne.)

1 specimen of *Anemone minima* from Virginia. (By exchange with Harvard University.)

66 specimens of flowering plants from North America. (By exchange with the Field Museum of Natural History.)

1 specimen of *Corallorhiza Wisteriana* from Georgia. (Given by Miss Caroline C. Haynes.)

144 specimens of flowering plants from the southeastern United States. (By exchange with the Royal Botanic Gardens, Kew.)

28 specimens "Fungi Dakotenses." (Distributed by Dr. J. F. Brenckle.)

20 specimens "North American Musci Perfecti." (By exchange with Dr. A. J. Grout.)

900 specimens of ferns and flowering plants from Florida. (Collected by Dr. John K. Small.)

102 specimens of flowering plants from Brazil. (By exchange with the Royal Botanic Gardens, Kew.)

38 specimens of flowering plants from Gulf of St. Lawrence region, Canada. (By exchange with Brother Marie-Victorin.)

2 specimens of sedges from French Guiana. (By exchange with Mr. M. A. Lemie.)

10 specimens of fungi from Santo Domingo. (By exchange with Dr. Raffaele Ciferri.)

796 specimens German Uredineae. (Purchased from Mr. T. O. Weigel.)

1 specimen of *Patella theleboloides* from China. (By exchange with Mr. F. L. Tai.)

3 specimens of fungi from Jamaica, West Indies. (By exchange with Professor J. N. Couch.)

14 specimens of fungi from Wisconsin and New York. (Collected by Dr. A. B. Stout.)

14 specimens of fungi from France. (By exchange with Dr. G. Malencon.)

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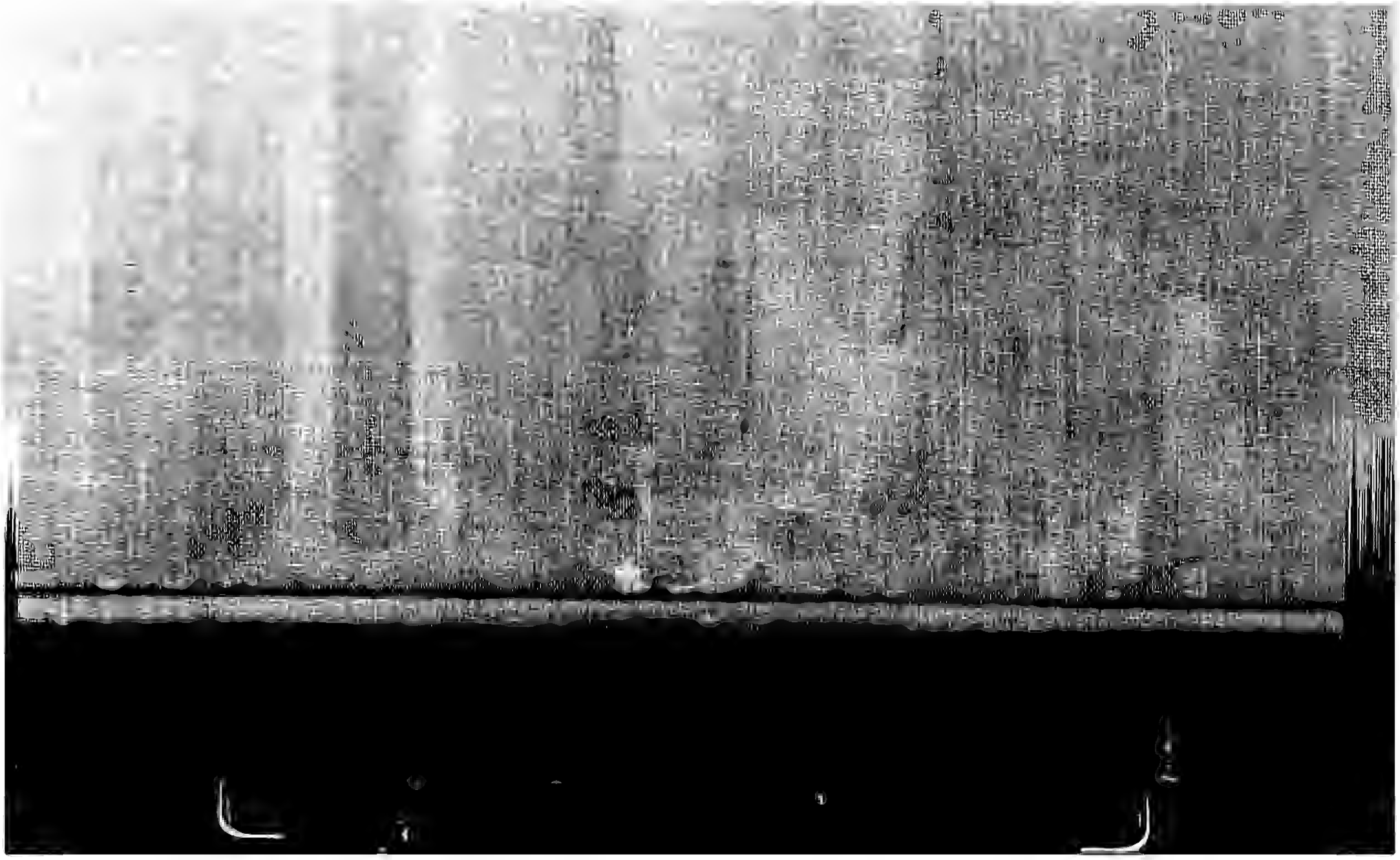

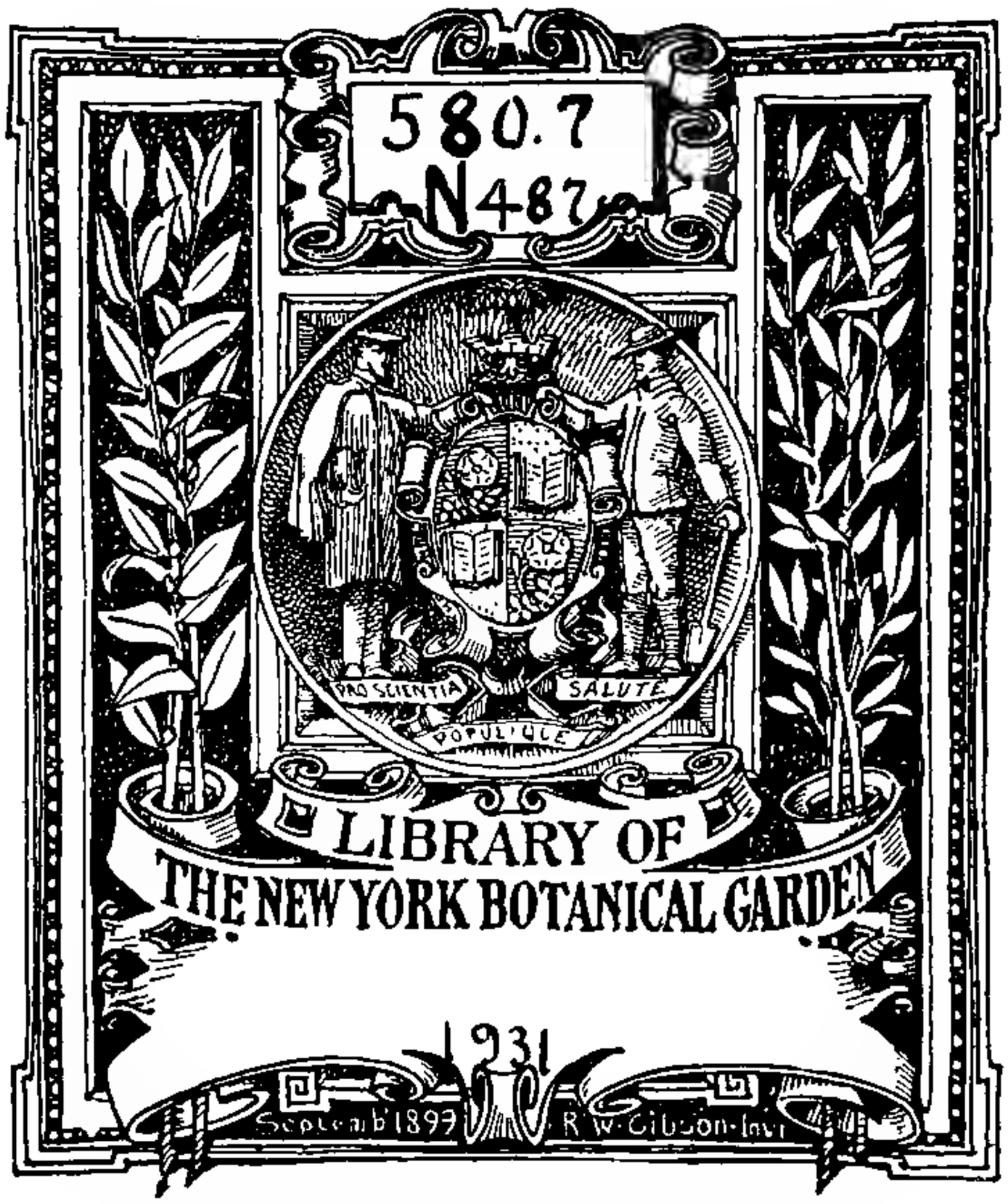
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VOL. XXXII JANUARY, 1931 No. 373

THE BRITTLE-THATCH THRINAX MICROCARPA[1]

It would be interesting to know if the Brittle-thatch was the first palm encountered by Columbus and his associates when they landed in the Bahamas on their first cruise to the New World. Perhaps it was, for it is common nearly throughout that archipelago, as it is in other parts of the West Indies, where the aborigines doubtless used it in the construction of their dwellings, just as the present inhabitants do.

From its use for siding and roofing, it early had the name thatch or thatch-palm applied to it and this name has persisted.

Thrinax is typically a West Indian genus of palms. It was first established in 1788 by the description of specimens from Jamaica, when our other *Thrinax* (*T. parviflora*) was botanically named and described.

Plants belonging to this genus were referred to, however, although not botanically named and described, in literature concerning the Bahamas long before the genus was technically described from the Jamaica plants.

About two hundred years ago, Mark Catesby[2] in writing of "The Thatch Palmetto" of the Bahamas, said:

[1] Including *Thrinax keyensis* Sarg.

[2] Mark Catesby was born in 1679, at Sudbury, Suffolk, England. From 1712 to 1719 he was in Virginia; during this time he collected numerous scientific specimens, sending the botanical ones to Dr. Samuel Dale (1659–1739), of Braintree, in Essex. Upon his return to England, he was encouraged by promises of financial support from various sources to visit America again for the express purpose of studying and painting natural objects. He arrived in Charleston in May, 1722, and remained there for some time, exploring the vicinity and even the interior; he then went to Georgia and Florida, and, in 1725, to New Providence, where he maintained his headquarters while visiting several other islands of the Bahama group. In 1726 he returned to En-

FIGURE 1. On Big Pine Key, Florida. Brittle-thatch growing on plate rock (oölitic limestone). This specimen represents the form with stiff leaves, the segments of the blades being relatively short, broad, and straight.

"This tree seldom aspires above twelve or fourteen feet. The leaves grow low and spreading, and are particularly made use of for building houses, they serving both for walls and covering."[3]

Today the same conditions obtain there as they did centuries ago. The plaiting of the leaf segments and the binding of the thatch to the frames of a house, and the crude, often mahogany, rafters of the roof are frequently works of art.

About a decade after the discovery of the thatch-palm in Florida very little was known concerning the species and its geographic distribution, as is shown by the following paragraph written by C. S. Sargent:[4]

"The last of our genera, Thrinax, is exclusively West Indian or Floridian, with a few species of small trees and shrubs distinguished by large handsome fan-shaped leaves often silvery white on the lower surface, minute flowers with calyx and corolla confluent into a short cup, and small, fleshy or dry fruits. The Florida species are not well known, and there are probably four arborescent species on the keys, although at present no other North American trees are so little known as this group of Palms."[5]

Later in the same year we find it recorded by the same author that:

"In 1879, Mr. A. H. Curtiss[6] found on No Name and Boca Chica keys another Thrinax which has been referred to as *Thrinax*

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gland, and spent the remainder of his life, more than twenty years, in engraving and coloring with his own hand his monumental work "The natural history of Carolina, Florida, and the Bahama Islands." This was published in eleven parts of twenty plates each, with descriptive text, from 1730 to 1748. Catesby died in London, 23 December, 1749. —JOHN HENDLEY BARNHART.

[3] The Natural History of Carolina, Florida, and the Bahama Islands. xli. 1732.

[4] Charles Sprague Sargent was born 24 April, 1841, at Boston, Massachusetts. After graduation from Harvard University in 1862, he entered the army, leaving the service at the end of the Civil War as brevet major of volunteers. He was director of the Arnold Arboretum, at Jamaica Plain, Massachusetts, from its establishment in 1872 to his death, 22 March, 1927, and thus devoted about fifty-five years to the study of woody plants. His work in the development of the Arboretum, and his numerous elaborate publications, have made his name familiar to all botanists and tree-lovers.—J. H. B.

[5] Garden and Forest 9: 152 1896.

[6] Allen Hiram Curtiss was born 9 February, 1845, at Central Square, Oswego County, New York. In his youth the family removed to Vir-

PLATE 2. On Big Pine Key, Florida. Brittle-thatch growing on plate rock (oolitic limestone). This specimen represents the form with pliable leaves, the segments of the blades being relatively long, narrow, and more or less drooping.

argentea Desfontaines, but it now turns out to belong to another section of the genus (Porothrinax) and appears to be undescribed. . . . The size of the fruits suggests the name of *Thrinax microcarpa* for the species . . . . . *Thrinax microcarpa* grows on dry coral soil on No Name Key, Bahia Hunda [Honda] Key, and the shores of Sugar Loaf Sound, Florida."[7]

Following the above quotation a paragraph reads thus:

"On the Marquesas Keys and on some of the small keys east of Key West there is another Euthrinax whose flowers are still unknown."[8]

The plants referred to in the above quotation were later made the type of another species, the original description of which was followed by the appended note, also by C. S. Sargent:

"*Thrinax keyensis* inhabits the north shore of the largest of the Marquesas group of islands about fifteen miles west of Key West, where it was first seen by me in November, 1886, but without flowers or fruit, and where there are several large groves; it grows also on Crab Key, a small island to the westward of Torch Key, one of the Bahia Honda group. It is this plant which I referred to EUTHRINAX (Garden and Forest 9: 152; Silva 10: 50), with the mistaken idea that the large black fruit which I had gathered on the Marquesas in 1886 had been produced by this tree. Seeds of *Thrinax keyensis* were distributed from the Arnold Arboretum in December, 1898, as *Thrinax* no. 3."[9]

Although two species have been described, there is nothing convincing in all that has been written about them to prove that two species really exist in nature. The interpretations were based on entirely too little field-work and the distinguishing characters cited are trivial. The strongest evidence that supports the two-species

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ginia, where he began to collect plants for distribution. In 1875 he settled in Florida, which was his home for the remainder of his life. For many years he was a professional collector, and his specimens, with printed labels, are to be found in nearly all the large herbaria of the world. He was the discoverer of many of the plants of southern Florida. During the last five years of his life he extended his activities to parts of the West Indies. He died at Jacksonville, 1 September, 1907.—J. H. B.

[7] Garden and Forest 9: 162. 1896.

[8] Garden and Forest 9: 162. 1896.

[9] Botanical Gazette 27: 87. 1899.

theory is without the plants themselves, or ecologic, the habitats of the type specimens of the two proposed species. The one—*Thrinax microcarpa*—came from the pinelands of No Name Key, while specimens of the other—*Thrinax keyensis*—came from the Marquesas Keys, which indicate a hammock environment.

It is therefore evident that one of two conditions obtain, namely, there are two closely related species of the sessile-fruited group of *Thrinax* in Florida, as well as the distantly related *T. parviflora,* the one a pineland plant, and the other a hammock plant, or there is one species which inhabits naturally both pinelands and hammocks.

Now, the phytogeographic evidence naturally inclines to the former alternative, for, except in the cases of two widely distributed species, such as the cabbage-tree (*Sabal Palmetto*) and the saw-palmetto (*Serenoa repens*), our palms are usually particular as to their habitats and plant associations.

Influenced by the pineland-hammock theory the writer recently made several field-studies extending from Key Largo to Key West, with the hope of solving the problem. The study has not yet produced satisfactory positive results. It has shown that the diagnostic characters heretofore assigned to *Thrinax microcarpa* and *T. keyensis* exist in both species. The problem is further complicated by the existence of two forms of *Thrinax* in the pinelands of the lower Florida Keys that must for the present be referred to *T. microcarpa.* Examples of these forms are shown in the figures accompanying these notes. In the one form the leaves are stiffly spreading, the lobes often relatively short, and their tips spreading. In the other form the leaves are rather loosely spreading, the lobes usually elongate and more or less drooping at the tips. So far, we have not been able to find any differential characters in the inflorescence, either in flowers or fruits.

As matters now stand, the problems of the genus *Thrinax* in Florida can be solved only by the further gathering of abundant direct evidence in the field, which means a thorough survey of the Florida Keys on the reef and Cape Sable region on the mainland, for the genus is represented nearly the length of the chain of keys and on the Cape Sable crescent.

JOHN K. SMALL.

7

INSECTS IN RELATION TO PLANT LIFE[1]

The relations existing between insects and plants are exceedingly varied and extremely interesting. It is well known that insects as well as other animals depend more or less directly upon plant life for sustenance. All of our herbivorous animals, such as domestic stock, deer, and the like, are absolutely dependent upon plants for food; and the meat-eating animals, or Carnivora, are in turn dependent upon the Herbivora or plant-eaters. Some animals have learned to depend upon plants for more or less shelter; as, for example, birds which nest in trees and squirrels which live in holes in trees. The insects have gone much farther than this and have established very close biological relations with plant life. One of the most important is the fertilization of many flowering plants, such as our fruit trees, apple, pear, plum, and the like. The production of these crops is practically dependent upon the abundance of insect life. The insects in turn obtain from the flowers the highly prized nectar. Both insects and plants have special adaptations to facilitate this process of pollination. The hairy vestiture of the body of the insect and, in the case of some bees, the pollen baskets, etc., provide special means for carrying pollen. On the other hand, flowers develop structures which make it impossible for insects to enter them without coming in contact with both the stamen and the pistil; and in this way they carry pollen from one blossom to another. Many orchids have developed an adhesive pollen mass which is carried to the next blossom visited. Even our common milkweeds are not above resorting to devices which literally compel a visiting insect to carry pollen from one flower to another. The inter relations incident to pollination are extremely interesting and could be readily discussed at considerable length.

Like the higher animals, insects find shelter in the stems of various trees and other plants; in addition, in the case of numerous gall insects, they practically compel the plants to grow special shelters for them and their progeny. There is a long series of leaf miners which infest the foliage of many species of plants and obtain food and shelter in this way. The cambium miners of trees

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, October 18, 1930.

also come in this class. Certain insects are so dependent upon plant life that they feed only upon some plants; as, for example, the codling moth, occurring commonly in the apple, the bean weevil, which restricts its operations to the bean, the nut weevils, which are found so commonly in various nuts. Each species is definitely restricted as to the food plant in which it may live. A long series of insects attack the buds, and find in the delicate developing tissues just the conditions necessary for growth. Some insects go beyond this and actually grow plants, particularly fungi, upon which they depend for nourishment. This is true of certain of the fungus-growing ants and also of a considerable number of ambrosia beetles, so named because they actually grow a fungus within their galleries, and in the case of both the ants and the ambrosia beetles, a small portion of the fungus is taken during migration from the old quarters to the new. The agricultural ants of the Southwest harvest the seeds of certain grasses in order to perpetuate a food supply. Insects are very discriminating botanists and not a few distinguish readily between closely related plants. For example, the moths of the forest tent-caterpillars, which do not feed, deposit their eggs freely on the twigs of the sugar maple and none upon those of soft maples, even though the branches may be interlocking. Every part of a plant, the bud, the leaf, the fruit, the twig, the branch, the trunk, and even the roots may be subject to insect attack, and in not a few cases, a large number of insects find food and sustenance upon certain species of plants. Our oaks are known to support over 500 different species of insects, quite possibly twice that number. Over 400 or more kinds of insects live upon apple trees. Clover is affected directly or indirectly by some 200 species; and corn is attacked by about an equal number. Even the poison ivy is not exempt from insect depradations.

The alternation of food plants is also a very interesting phenomenon. This is especially well marked among the plant lice; and we have a striking instance of this in the alder blight and the woolly aphis of the soft maple. These were formerly supposed to be different. The gall aphids on the spruces also have alternate food plants; and, in some cases, the life cycle is very complex.

The introduced insects are worthy of mention because of their great economic importance. Somewhat over half of the more in-

jurious or destructive insects affecting agricultural crops and shade trees have come to us from abroad. Presumably, it is only necessary to mention such pests as the gipsy moth, the elm-leaf beetle, the Japanese beetle, the willow-leaf beetle, the European corn-borer, the cotton-boll weevil and the Mexican bean beetle to give some idea of what these mean to this country.

The hosts of plant-frequenting insects are in turn subject to attack by large numbers of beneficial insects, the parasites and the Predatores. These are exceedingly important in the economy of nature, and do much to prevent many insects from becoming so abundant as to be serious scourges. The common apple tent-caterpillar, well known because of the conspicuous white tent-like nests upon wild cherry and in apple orchards in early spring, is occasionally extremely abundant on account of the fact that conditions in preceding seasons have been unfavorable to the development of a long series of parasites. The white-marked tussock moth, a well-known pest of shade trees, especially the linden, the horse chestnut, the elm, and the maple, presents an extreme in parasitism, since there are not only parasites which prey upon this insect, but parasites which prey upon its parasites. These are known as hyper-parasites. The hyper-parasites in turn are preyed upon by others; and to make the matter a little more complex, the hyper-parasites of the hyper-parasites may in turn fall victims to other parasites. This gives a little idea of the complexity of the biological forces in operation all around us.

A long series of insects bore into dead and decaying wood or the practically lifeless heartwood of trees. These are injurious viewed from the practical standpoint of the lumbermen. They are beneficial in the broader biological sense, since they are very effective agencies in hastening decay and preventing natural woodlands from becoming choked, as it were, with fallen trees. They assist very materially in reducing the dead wood to soil.

The conflict between plants and insects is not altogether one-sided. In the case of many of the sapwood borers, there must be an invasion of sufficient numbers of the insects or they will be literally drowned out by the super-abundant sap. Not a few leaf-feeders respond rather closely to the physical condition of the plant and become exceedingly abundant upon those in a weaker condition, more light and a drier atmosphere presumably being

important factors, than is possible in the case of trees with an abundant foliage. It is certain that these latter can successfully carry a heavier infestation than the former. There are, in addition, some plants, the sundews, which actually trap insects and derive nourishment from their victims. The same is true of certain pitcher plants. Fungi, which belong with the lower plants, are also deadly enemies of insects. Our common house-fly succumbs in large numbers in the fall to a whitish fungus known as *Empusa Muscae*. Related species attack plant lice, crickets, grasshoppers, and caterpillars. One of the most peculiar of these fungi, Isaria, known in the asexual stage as Cordyceps, develops in the white grubs of the May beetle or June beetle and in the horny, yellowish wireworms or grubs of the snapping beetle, in both instances producing a relatively enormous plant growth issuing from the body of the victim, just behind the head and extending frequently to a length of several inches.

Man is a builder, so are insects. The nests of various paper wasps are well known. The material, in the case of the white-faced hornet, is gathered mostly from weathering wood surfaces. The large European hornet very commonly gnaws away the outer bark of various shrubs, particularly lilac, sometimes ornamental box, and uses this material in the construction of its nest. The leaf-cutter bees remove circles a half inch or so in diameter from rose or other leaves, and use them in the construction of cells built in previously hollowed-out plant stems. Many small, active, wriggling, green caterpillars, the leaf-rollers, draw the leaves of various trees and shrubs together, fastening them with strands of silk and thus build shelters. A species of ant does the same, the workers pulling the leaves together and actually using the young or larva as a silk-spinning instrument to fasten the leaves in place.

One group, the scale insects, deserves a little notice, since many of them are very closely related to their respective food plants and, moreover, are dependent in large measure upon other than their own powers for dissemination. Birds are presumably efficient carriers of the young of scale insects; and there is also evidence to show that they may be transported some distance by winds.

E. P. Felt.

WILL OUR CHESTNUT TREE RETURN?[1]

The forests in and about the mountains of Pequannock and Towaco, in Morris County, New Jersey, were formerly famed for the abundance of their chestnut trees and for the production of the nuts. The chestnut blight was early and completely destructive in that region, and the last tree was destroyed many years ago. As is usual in such places, many of the roots survived and made fresh attempts to develop trees. These young growths followed the usual course of soon exhibiting signs of the disease, and dying after a more or less prolonged struggle, often being succeeded by further attempts at new growth.

Late in October of this year, I was surprised to receive a chestnut twig bearing nearly ripe burs, each containing one or more fertile nuts. I was told that they came from a seedling tree on my property, and that there were no other trees in the vicinity. This, if true, was contrary to the conclusions reached by Stout, that fertilization of the ovules requires pollen from a different tree, so I lost no time in making an investigation, with the following results. The tree did not grow on my property, was one of several, in close proximity, all of which had fruited, and all of which showed unmistakable signs of the blight. They were all shoots produced from old stumps, growing on an open hillside and they appeared to be nine or ten years of age. I then made a partial survey of my own woodland, comprising ten or twelve acres, where large chestnut trees formerly abounded. This resulted in the finding of eight young trees, two of them growing from old stumps, the others seedlings. They appeared to be from seven to ten years of age. Only the two growing from stumps showed clear signs of the blight. One of these seedlings may be slightly affected. I have cleared away the forest growth from around these trees and shall watch their development with care.

[1] The observations of Dr. Rusby are of interest in connection with similar reports recently published in The Rural New-Yorker and elsewhere. In view of the fact that the chestnut blight was first discovered in Bronx Park (New York Zoological Park) and was first described and figured in this Journal (7: 143–153. *f. 13–19.* Je 1906) by Dr. W. A. Murrill, at that time its editor, it seems most fitting that Dr. Rusby's note of encouragement, nearly twenty-five years later, should appear in the same periodical.—Ed.

FIGURE 3. Fruit of American chestnut, ripening in Morris County, New Jersey, October, 1930.

I have since learned of many young trees, in widely separated parts of New Jersey, which have fruited this year. I have noted the presence in the New York market of a very much larger supply of our native chestnuts this year than has appeared for a decade past.

H. H. Rusby.

ONE HUNDRED KINDS OF BANANAS[1]

Southeastern Asia is probably the native home of the cultivated bananas. Seedy, wild bananas are found there in open spots of the forest, where they are eaten by the monkeys and birds, and their seeds scattered far and wide. There are more different kinds of bananas in that region, too, than in either Africa or tropical America. While the evidence of oriental origin for the banana is very strong, some authorities maintain that the first species of bananas arose in America; and the evidence of banana like seeds and banana-like leaves in America in prehistoric times seems to support this theory. Of the five other genera of the banana family, Lowia, Orchidantha, Heliconia, Strelitzia, and Ravenala, one of the closest relatives, the Ravenala or traveler's tree, has only two surviving species: one in Madagascar and the other in Northern South America.

Whatever may have been its origin, the seedless edible banana was carried by man to most parts of the tropics before the dawn of history; and he has developed hundreds of different varieties for many different uses. One, the Abaca, is the source of Manila hemp, the best fibre for rope. The Abyssinian banana is grown for its fleshy edible rootstock. Some of the oriental varieties are specially rich in starch and are used for meal. One has so much banana oil that it us used as a source of that material and is entirely unfit to eat. The little pear-shaped fig-banana is principally valuable as a dried fruit. There are two great groups of the edible banana tribe that are palatable only when cooked; and some of these are best suited for frying, others for baking or boiling. Most of us in the North think only of the bananas that are eaten raw; and it is rather surprising, with the hundreds of varieties avail-

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on October 25, 1930.

able, that only three commonly come into the American market. The most important of all is the common yellow Jamaica or Gros Michel variety. The red banana is never abundant in our markets; and the Chinese dwarf, which is the only variety grown commercially in the Canary Islands, the Azores, and Hawaii, is seldom seen in the East, though it is common in the California markets.

While we think of the banana as a tree, and it does grow from twenty-five to thirty feet tall, it is, more properly speaking, the biggest of our herbs, since it has no woody stem and what we call its trunk is simply a cluster of leaf stalks closely packed together. Practically all of our edible bananas are seedless and are propagated by suckers coming up from the root. A detached sucker planted in good rich soil will mature its first bunch of bananas in about a year. The single stalk bears just one cluster of fruit, then dies down to the ground, being replaced by three or more new sprouts. These grow very rapidly until they are about to flower; then, while the long flower stalk is pushing up among the leaves toward the top, the growth of the rest of the plant comes to almost a standstill for about ten days. Soon after the young bud appears among the leaves, it bends over and hangs downward. The first eight to twelve groups of flowers are the fertile ones which develop into the bananas. The later flowers produced at the end of the stalk are staminate ones and produce only pollen and honey, but make quantities of both. A mature banana flower one or two inches long is half full of sweet nectar. The banana flower-buds are covered with fleshy, thick, leafy scales tightly overlapping each other like a small cone-shaped cabbage. The natives of the tropics often cut off this banana cabbage as soon as all of the fertile flowers have appeared and cook it for food. The banana leaves of some varieties are so waxy that they are used for waxing floors or for waxing irons in the laundry. The juice of the banana is clear and watery but contains so much tannin that when it gets on the clothing and is afterward ironed in the laundry it darkens to a black indelible stain. Of course, when the fruits are harvested the old stalks are cut down, as they are no longer of any use; but in some parts of the tropics even these waste stalks are fed to the pigs and the leaves are used for wrapping food and small parcels. If it is true that the pork packers of Chicago use all parts of the pig except the squeal, the same can be said about all parts of the

useful banana plant. The bananas that come into the markets of the world are nearly all grown by an American company in the West Indies and Central America and transported to us by American ships. If we wish to develop a true American merchant marine of any magnitude, we cannot do better to stimulate it, than to establish a few more overseas industries as large and successful as the banana industry. The banana not only enjoys a remarkably wide popularity; it fully deserves all of the commendation that is given it. It is the only commonly used fruit that has a food value in any way equal to the potato or any of our staple foods. Pound for pound the banana has fully as much value as the potato and compares favorably with many of our other common foods. Many people have assumed that it is not very digestible. The reason why it has gained this reputation is that most Americans, with characteristic impatience, eat it before it is ripe. This bad habit is aided and abetted by the banana itself; for when it looks most attractive with bright yellow skin and green tip it is far from truly ripe. If you wait until the whole fruit is speckled brown all over and there is no longer any trace of green on it anywhere, then it is at its best, sweetest, most tender, and most palatable.

The lecture was illustrated by lantern slides and was followed by a two-reel film, showing banana industry in all of its phases. An interesting exhibit of ripe and green bananas and of some of the unusual varieties was furnished by the United Fruit Company; and samples of the fruit in proper edible condition were distributed to the audience.

FORMAN T. MCLEAN.

ACONITES AND OTHER DRUG PLANTS[1]

Aconites are a group of Ranunculaceous plants, growing in the higher mountainous regions of the North Temperate Zone. Their distribution seems limited by the presence of the native bumblebees, which are the only insect pollinators of this plant. With the great number of species under observation at The New York Botanical Garden, a continuous period of bloom has been noted from the early part of June until after the first few light frosts. Most aconites grow from three to four feet in height, although

[1] Abstract of a lecture given at The New York Botanical Garden on Saturday afternoon, November 1, 1930.

some may reach eight or nine feet. Dwarf species suitable for rock gardens and edging plants attain but a few inches. While various shades of blue predominate, white, yellow, light pink, mauve, and other intermediate shades are found in the wide range of the species. The majority of the species are erect in habit but a few are climbers. *Aconitum Anthora* seems to be the only one that requires full sun. The other species seem at their best in semi-shade and in damp locations. The horticulturist seems to have overlooked the possibilities of this charming group of plants.

Aconite is mentioned in the writings of Homer. The Gauls and Chinese apparently used the poisonous tuber-like root portion in the preparation of poisoned arrows. The use of aconite in medicine dates back about 175 years. Alkaloids are the constituents to which the pharmacological activity is due. Each species of aconite yields a different kind of alkaloid in chemical structure and in medicinal activity. The aconites need re-investigation in the light of newer scientific methods, as great possibilities exist for new and unknown constituents present in the species that have not yet been studied either botanically or chemically. Alkaloidal studies take on a new interest at the present time since they are the starting-point for many other chemical compounds that can not as yet be made synthetically in the laboratory.

The scientific method of the cultivation of medicinal plants is an imperative need of the present if we are to supply the medical profession with standard drugs. This branch of applied botany as it relates to drugs is known as pharmacognosy. Aconites are propagated both by seeds and so-called daughter tubers. The seeds take from one to two years to germinate but with specialized treatment the seeds of certain species have been made to germinate in five days.

The aconite flower has a peculiarly shaped hood, which partly encloses the rest of the flower and for this reason they are called monkshoods. The floral mechanism, with its variously modified nectaries, makes it an ideal flower for study of insect visitation. The commercial methods of gathering aconites were explained.

The lecture was illustrated with lantern slides, showing the various phases in the cultivation as well as the wide range of color in the aconites. Living plants, seedlings, and late-blooming flowers were on display.

WILLIAM J. BONISTEEL.

CORREVON'S ROCK GARDEN AND ALPINE PLANTS[1]

Monsieur Correvon's discussion of rock garden plants and their needs in garden culture is an admirable contribution to gardening literature, whether considered from a literary or a horticultural viewpoint. As a book to read, it is both entertaining and soundly instructive—truly a rare combination. His style is easy and agreeable, and his cultural directions are clear and non-technical. Of course, it is a book more for the gardener than the botanist, and written as it is by such an outstanding authority on rock gardening and the culture of alpine plants, it is a welcome addition to any gardening library.

His first eleven chapters are devoted first to a very general discussion of rock gardening in England and America, then to general principles of construction and maintenance of suitable gardens for alpines, wall-garden plants, ferns, terrestrial orchids and cacti. This he follows with 380 pages devoted to detailed discussion of the many species of these groups that have come under his observation—and their name is legion.

In spots his botany may be faulty, as in the case of our common New York Fern, which he lists twice, once as an Asplenium, and again as Nephrodium, and lists as coming from Northwest United States. Also, his experience regarding the adaptability of the different plants to culture is obviously European, and the American gardener must find by his own experience which plants will thrive with him. For many of the exotic alpines are so exacting that every gardener must find for himself whether or not they will succeed locally with him. But M. Correvon's advice will certainly be a valuable guide, in telling just what precautions are necessary reasonably to assure each plant a fair chance of success.

FORMAN T. MCLEAN.

JONES' SOME FAMILIAR WILD FLOWERS[2]

In *Wild Flowers,* Magistrate Jones, of Toronto, presents charming photographs of over 200 favorites. For the amateur they are excellent, as in most cases the flowers are depicted both

[1] Correvon, Henry. Rock garden and alpine plants. Pp. xiv + 544. 7 f. + *16 pl.* (*8 col.*). The Macmillan Co., New York, 1930. $6.00.

[2] Jones, James Edmund. Some familiar wild flowers. n. p. *f. 1–272.* The Macmillan Company, New York, 1930. $1.50.

artistically and clearly. This is especially true of the full-page illustrations. The only addition we suggest would be the mention of the relative sizes of the flowers. For, in many instances, the flowers are reproduced in such a way as to give the uninitiated no idea of their sizes. For example, in the small plates, *Trillium grandiflorum* (large trillium) looks larger than *Castalia odorata* (small water lily); *Prunus pennsylvanica* (pin cherry) appears six times the size of *Prunus virginiana* (choke cherry). But making allowance for size relationships, we believe the book will prove both delightful and useful to the wild flower enthusiast. The photographs are mostly by Richard S. Cassels, K. C., of Toronto. The book includes suggestions for the making of an herbarium and warnings as to plants that are in need of conservation.

C. M. ADAMS.

EMERGENCY EMPLOYMENT AT THE GARDEN

Through the coöperation of the Prosser Emergency Employment Committee and the Association for Improving the Condition of the Poor, The New York Botanical Garden is providing winter employment for about eighty men and nearly ninety women in addition to its regular employees. The men, when the weather is favorable, are doing outdoor work, such as grading, making paths, cleaning the grounds, painting fences, removing weeds from lawns, etc. The women clean exhibition cases in the museum, poison and mount herbarium specimens, clean and repair herbarium sheets, assist in the library and laboratories, do typewriting and bibliographic work, etc. Mr. Seward Prosser, chairman of the Emergency Committee, has personally visited the Garden and has expressed himself as highly pleased with the arrangement, which gives work to those who are sorely in need of it and at the same time results in the doing of work that greatly needs to be done.

EXTENSION STUDENTS ACCORDED PRIVILEGES OF GARDEN MEMBERSHIP

By a resolution passed by the Executive Committee of the Board of Managers of The New York Botanical Garden on December 17, students enrolled in extension courses at the Garden,

the fees for which amount to at least ten dollars, will be automatically enrolled as annual members for the year, without further charge.

Members of the Garden are also cordially invited to take advantage of these courses of study, and the privilege is extended to them of taking, without charge, any one such course, the fee for which is ten dollars or less.

NOTES, NEWS, AND COMMENT

Dr. N. L. Britton, Director Emeritus, and Mrs. Britton, Honorary Curator of Mosses, are spending the winter in Porto Rico.

Dr. A. B. Stout lectured December 2 on "Sterilities in Plants" before the Curie Science Club of the New Jersey College for Women at New Brunswick.

Dr. H. M. Hall, of Stanford University, California, ecological research investigator of the Carnegie Institution, spent several days of Christmas week in consulting the Garden's library and herbarium.

Dr. L. O. Overholts of the Pennsylvania State College, instead of attending the meeting of the American Association for the Advancement of Science at Cleveland spent several days at the Garden studying collections of Polyporaceae.

The Yokohama Nursery Company recently presented to the Garden three cases of lily bulbs, comprising a total of 1,030 bulbs of sixteen different species and varieties for use in experimental work and in display plantings.

Dr. Elmer D. Merrill, Director-in-Chief, spoke on "The Botanical Garden and the Community" at the annual meeting of The Bronx Board of Trade, held in the Rose Room of the Concourse-Plaza, 161st Street and Grand Concourse, on Wednesday afternoon, December 17. He discussed the national and international as well as the local aspects of the Garden.

At the meetings of the Botanical Society of America, American Association for the Advancement of Science, American Phytopathological Society, etc., held in Cleveland, Ohio, December 29–

January 1, The New York Botanical Garden was represented by Drs. E. D. Merrill, F. J. Seaver, B. O. Dodge, and Arthur Hollick, all of whom had parts in the program. Dr. Merrill was elected vice president of the Association and chairman of Section G and Dr. Seaver was elected chairman of the Mycological Section of the Botanical Society of America.

The following visiting botanists enrolled in the library during the autumn: Dr. Ivan M. Johnston, Gray Herbarium, Cambridge, Mass.; E. H. Eames, M. D., Bridgeport, Conn.; Mr. James A. G. Davey, Sound Beach, Conn.; Mr. O. W. Barrett, N. Clarendon, Vt.; Prof. A. Le Roy Andrews and Mr. S. H. Burnham, Ithaca, N. Y.; Prof. M. A. Chrysler, New Brunswick, N. J.; Mr. Edwin B. Bartram, Bushkill, Pa.; Prof. J. B. S. Norton, College Park, Md.; Prof. Charles S. Parker, Dr. M. A. Raines, Dr. Albert F. Woods, and Mr. E. P. Killip, Washington, D. C.; Dr. David Fairchild, Coconut Grove, Fla.; Prof. Gilbert M. Smith, Stanford University, Calif.; Mr. Carl Purdy, Ukiah, California.; Mr. Paul F. Shope, Boulder, Col.; Mr. D. Le Roy Topping, Honolulu, T. H., and Dr. N. I. Vavilov, Leningrad, U. S. S. R.

Meteorology for December. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 51° on the 1st; 52° on the 10th; *55° on the 18th;* and 44° on the 22nd. The minimum temperatures recorded were: 15° on the 3rd; 20° on the 14th; *9° on the 17th;* and 26° on the 25th. The total precipitation for the month was 2.35 inches; this includes 7 inches of snow which was figured as 0.70 inches of rain-fall.

Meteorology for the year 1930. The total precipitation for the year was 32.09 inches, including a total snowfall of 13½ inches, which is figured as equal to 1.35 inches of rainfall. This was distributed by months as follows: January—2.46 inches (including 0.35 inches as melted snow or 3½ inches snow measurement); February—2.61 inches (including 0.30 inches as melted snow or 3 inches snow measurement); March 1.70 inches with only traces of snow; April 2.30 inches; May—3.27 inches; June—3.02 inches; July —2.61 inches; August— 2.74 inches; September—1.80 inches; October—1.21 inches; November—6.02 inches with

traces of snow; and December—2.35 inches (including .70 inches as melted snow or 7 inches snow measurement).

The maximum temperature recorded during the year was 103° on the 21st of July. The minimum temperature recorded was + 2° on the 16th and 17th of February.

The first killing frost of the autumn occurred on the morning of the 23rd of October. The latest freezing temperature of spring was 28° on the 24th of April.

ACCESSIONS

Museums and Herbarium

2 specimens of fungi from Japan. (By exchange with Mr. Seiichi Kewamura.)

29 specimens of fungi from South Dakota. (Distributed by Dr. J. F. Brenckle.)

363 specimens, "Reliquiae Holwayanae" from South America. Fascicles 1 4. 163 extras. (Distributed by the University of Minnesota.)

1 specimen of *Trichoglossum tetrasporum* from New York. (By exchange with Professor H. M. Fitzpatrick.)

201 specimens of plants from Siberia. (By exchange with Dr. Porphyry Krylov.)

20 specimens of flowering plants mostly from the region of New York. (Given by Dr. H. M. Denslow.)

1970 specimens of plants from Kwangtung Province, China. (Given by Dr. E. D. Merrill.)

4000 specimens of plants from Kansas and Minnesota. (Collected by Dr. P. A. Rydberg and Mr. Ralph Imler.)

441 specimens of flowering plants from California and neighboring states. (By exchange with Stanford University.)

317 specimens of plants from Anhwei Province, China. (Given by Dr. E. D. Merrill.)

1 specimen of *Alsine media* from peninsular Florida. (By exchange with Mr. M D. Cody.)

52 specimens of flowering plants from Mexico. (Collected by Dr. C. A. Purpus.)

2741 specimens of plants from the Philippine Islands. (Given by Dr. E. D. Merrill.)

106 specimens from Kwangsi Province, China. (By exchange with Mr. R. C. Ching.)

227 specimens of flowering plants from Mt. McKinley, Alaska. (Collected by Mrs. Ynes Mexia.)

114 specimens of flowering plants from western North America. (By exchange with the University of California.)

2 specimens of *Aconitum* and *Veronica* from Canada. (By exchange with Mr. William Rhoads.)

400 herbarium specimens from New Hebrides, Moluccas, New Guinea, and Celebes (from the Crane Expedition). (Given by Dr. E. D. Merrill.)

200 herbarium specimens from India. (By exchange with Mr. R. N. Parker.)

150 herbarium specimens from the Philippine Islands. (Collected by C. A. Wenzel.)

100 herbarium specimens from Rarotonga, collected by G. Wilder. (Given by Dr. E. D. Merrill.)

2000 herbarium specimens from Sumatra, collected by Dr. H. H. Bartlett. (Given by Dr. E. D. Merrill.)

1 specimen of *Cedrella velutina* (type). (By exchange with Dr. B. P. G. Hochreutiner.)

5 specimens of exotic orchids. (Given by Dr. H. M Denslow.)

236 specimens of plants from Shansi Province, China. (By exchange with Mr. T. Tang.)

208 specimens of plants from Chihli Province, China. (By exchange with Mr. F. T. Wang.)

350 specimens of flowering plants from Mexico. (Collected by Professor Marcus E. Jones.)

41 specimens of flowering plants from California and Arizona. (By exchange with the University of California.)

2 specimens of *Rhinanthus* and *Euphrasia* from Maine. (By exchange with Mr. William Rhoads.)

600 herbarium specimens from Chekiang Province, China, collected by C. Y. Chiao (Given by Dr E. D. Merrill.)

400 herbarium specimens from Java and Sumatra. (By exchange with the Botanic Garden, Buitenzorg.

1200 herbarium specimens from Japan, collected by G. Masamume. (Given by Dr. E. D. Merrill.)

500 herbarium specimens from China, Borneo, and the Philippine Islands. (Given by Dr. E. D. Merrill)

2 specimens of *Riccia fluitans* from Lower California. (Given by Dr. Donald A. Johansen.)

7 specimens of marine algae from California. (By exchange with Mrs. Nina H. Loomis.)

2 specimens of marine algae (*Asparagopsis hamifera* and *Ceramium rubrum*) from Long Island, N. Y. (Given by Mrs. Wm. Oberer.)

2 specimens of *Riccia* from Wisconsin. (Given by Dr. Geo. H. Conklin.)

42 specimens of Hepaticae from Juan Fernandez Islands. (By exchange with the Botaniska Trädgården of Göteborg.)

2 specimens of Characeae from Canada. (Given by C. R. Timm.)

1 specimen of *Riccia Sullivantii* from Maine. (Given by Dr. Geo. H. Conklin.)

324 herbarium specimens from Chihli Province, China. (By exchange with Mr. F. C. Li.)

75 herbarium specimens from Formosa. (By exchange with Professor Tyôzaburô Tanaka.)

1200 herbarium specimens from the Philippine Islands and Malaysia, collected by Dr. Otto Warburg. (By exchange with the Berlin Botanic Garden.)

400 herbarium specimens from Sumatra, collected by Dr. H. H. Bartlett. (Given by Dr. E. D. Merrill.)

1000 herbarium specimens from Queensland, Australia, collected by Mr. C. T. White. (Given by Dr. E. D. Merrill.)

288 specimens of flowering plants from the Pacific Northwest. (Collected by Mr. Lyman Benson.)

577 specimens of fungi from Colorado. (Collected by Dr. Fred J. Seaver and Mr. Paul F. Shope.)

1 specimen of fruits of *Eucalyptus Globulus* from Ireland. (Given by Mr. Robert S. Welch.)

162 specimens of flowerless and flowering plants from Venezuela and Costa Rica. (Distributed by Mr. Henri Pittier.)

75 specimens of ferns and flowering plants from Hawaii. (By exchange with Mr. Otto Degener.)

35 specimens flowering plants from Indiana. (By exchange with Mr. Charles C. Deam.)

19 specimens of flowering plants from Alberta. (By exchange with Mr. A. H. Brinkman.)

4 specimens of flowering plants from Cuba, Colombia, and Paraguay. (By exchange with the Royal Botanic Gardens, Kew.)

3 photographs of *Pyrxidanthera brevifolia.* (By exchange with Professor B. W. Wells.)

100 specimens of flowering plants from Mexico. (Collected by Dr. C. A. Purpus.)

52 specimens of flowering plants from Mexico. (By exchange with the Arnold Arboretum.)

112 specimens of flowering plants from Cuba. (By exchange with Riksmuseum, Stockholm, Sweden.)

41 specimens of flowering plants from Ecuador. (By exchange with Yale University.)

369 specimens of flowering plants from Peru. (Collected by Mr. Guillermo Klug.)

62 specimens of ferns from Brazil. (By exchange with Harvard University.)

197 specimens of flowering plants from North America. (By exchange with the U. S. National Museum.)

145 specimens of mosses from Hispaniola. (By exchange with the U. S. National Museum.)

1 specimen of *Actinostrobus* from Africa. (Given by Professor S. J. Record.)

96 specimens of flowering plants from North and South America. (By exchange with the Field Museum of Natural History.)

623 specimens of ferns and flowering plants from North America. (By exchange with the Missouri Botanical Garden.)

160 specimens of flowering plants from Venezuela. (Collected by Mr. Henri Pittier.)

275 specimens of flowering plants from Hispaniola. (Collected by E. J Valeur.)

1 specimen of *Solidago verna* from North Carolina. (By exchange with the United States Department of Agriculture.)

1 specimen of *Polygala bermudiana*. (By exchange with the Bureau of Plant Industry.)

6 specimens of *Chamaecrista obtusifolia* from Florida. (By exchange with Mr. Maurice Mulvania.)

197 specimens of flowering plants from Peru. (By exchange with the Field Museum of Natural History.)

1 specimen of *Solanum elaeagnifolium* from Florida. (Given by Mr. Severin Rapp.)

189 specimens of flowering plants from South America. (By exchange with the United States National Museum.)

1 specimen of *Pedicellaria pentaphylla* from Texas. (Given by Professor Albert Ruth.)

1 specimen of *Valerianella* from Pennsylvania. (Given by Dr. J. P. Kelly.)

275 specimens of Siberian plants. (By exchange with the University of Tomsk.)

100 specimens of flowering plants from Patagonia. (By exchange with the Field Museum of Natural History.)

119 specimens of flowering plants from western North America. (By exchange with the California Academy of Sciences.)

130 specimens of flowering plants from northern South America. (Collected by Mr. Henri Pittier.)

100 specimens "Flora Cechoslovenica Exsiccata." (Distributed by K. Domin & V. Krajina.)

732 specimens of flowering plants from the United States. (By exchange with the Arnold Arboretum.)

570 specimens of Indian and Burmese plants. (By exchange with the Forest Research Institute and College, Dehra Dun.)

233 specimens from British North Borneo. (Given by Dr. E. D. Merrill.)

450 specimens of flowerless and flowering plants from Porto Rico. (Collected by Dr. & Mrs. N. L Britton.)

577 specimens of Peruvian plants. (Collected by Mr. Guillermo Klug.)

2100 herbarium specimens from the Philippines, New Caledonia, and Sumatra. (By exchange with the Botanical Garden, Berlin, Germany.)

141 specimens of flowering plants from the Lemmon herbarium. (By exchange with the University of California.)

250 specimens of flowering plants from Brazil. (By exchange with the Riksmuseum, Stockholm.)

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GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 41,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

Conditional bequests may be made with income payable to donor or any designated beneficiary during his or her lifetime.

All requests for further information should be sent to

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JOURNAL
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NOTES ON NEW HYBRID DAYLILIES
A. B. STOUT

THE FANLEAF-PALM—WASHINGTONIA FILIFERA
JOHN K. SMALL

CALIFORNIA WILD FLOWERS
CARL PURDY

BOTANICAL EXPLORATION OF THE ISLAND OF HAINAN
MARSHALL A. HOWE

NOTES, NEWS, AND COMMENT

ACCESSIONS

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NOTES ON NEW HYBRID DAYLILIES

The project of hybridization and selective breeding with daylilies (*Hemerocallis*) has steadily progressed since a popular report of this work was published in this JOURNAL five years ago.[1] The collection of species and horticultural clons has been extended until it now includes members of all but a very few of the known daylilies. Through the assistance of various persons in China and Japan, living plants and viable seeds of wild daylilies have been obtained from several widely separated regions in the Orient. No two of these collections have been alike and in no case have the plants obtained duplicated or even closely resembled the type of the same species already in cultivation. Among the plants obtained there has been one new and distinct species which has been named *Hemerocallis multiflora*[2, 3] and also a new rose-flowered variety designated as *Hemerocallis fulva* var. *rosea*.[4, 5] These results justify the continued effort to obtain living plants and seeds of wild daylilies from as many localities as possible. There has been complete coöperation in the issuance of permits for introduction by the Plant Quarantine and Control Administration of the U. S. Dept. of Agriculture, and almost always the living plants survive shipment when they are sent in autumn or winter during their period of dormancy.

[1] New daylilies. Jour. N. Y. Bot. Gard. **26**: 169–178. Au 1925.
[2] *Hemerocallis multiflora*. Addisonia **14**: *pl. 464*. Je 1929.
[3] The new species *Hemerocallis multiflora*. Jour. N. Y. Bot. Gard. **31**: 34–39. F 1930.
[4] *Hemerocallis fulva rosea*. Addisonia **15**: *pl. 484*. Mr 1930.
[5] The fulvous daylilies—II The wild fulvous daylilies of the Orient. Jour. N. Y. Bot. Gard. **30**: 185–194. Au 1929.

At the present time the most promising of these new wild types, all of the species as they are known in cultivation, and various of the horticultural hybrids are being used in hybridizations and in selective breeding. In certain selections, and especially those for fulvous, red, and pink flower-colorings, as many as three generations of progeny have been obtained. The seedlings already grown or now being grown total about 10,000. Several thousand of these are at Skylands, the estate of Mr. Clarence Lewis, whose support in providing space and care for growing seedlings has greatly promoted the progress of the work.

It may be said that this collection of daylilies is being very fully utilized (1) for a taxonomic study of the various species, (2) for the experimental study of sterilities, (3) for cytological studies of the conditions and processes involved in sterilities and in fertilization, (4) for determining various aspects of heredity, and (5) in selective breeding for the development of new hybrids of merit as garden plants. The conditions in this group of plants are especially favorable to this combination of interest and research.

The matter of special concern in this report is that of the selection of seedlings that are to be propagated and named as horticultural clons. A very critical judgment is being exercised in these selections and the opinions of various persons are considered in making final choice. There are hundreds of fine seedlings and if the number to choose from were small any one of many of them might well be propagated for the trade. The aim is, however, to select only those of outstanding merit, to avoid naming numerous seedlings that are almost identical, and to hold even very good seedlings for a time in the hope that still better ones of the same type or class may appear. And so each year only the very best of the seedlings are designated for special observation and for comparison. Some are used in further selective breeding. At the present time there are numerous seedlings with splendid shades of pink and sprightly red colorings that are decidedly new to horticulture and worthy of general culture. But these are being held in reserve in the thought that plants equally good in color may be obtained which have larger and fuller flowers or somewhat better habits of growth.

Brief mention may now be made of the four seedlings named.

The Cinnabar Daylily

The special charm of the Cinnabar Daylily (Figure 1) is in the rich fulvous coloring of its flowers. The plant has an excellent and semi-robust habit of growth. In New York it blooms during July, and its flowers are of good size, widely open, and numerous.

The throat of the flower is a clear cadmium-yellow; the outer half of the petals is covered, or at times somewhat streaked, with a vinaceous-rufous shade of red, and the sepals are somewhat more solidly of this color. Both the sepals and the petals are

Figure 1. Flowers of the Cinnabar Daylily, showing face and side view, about one-half natural size. Some indication is given of the delicate coating of vinaceous-rufous coloring that covers the cadmium-yellow in the outer half of the face of the open flower.

strongly gold-glistening in sunlight. The flowers are, therefore, of a rich but delicate shade of brownish red.

At present there is no other variety in the trade that closely resembles the Cinnabar Daylily. It is judged to be the best for its particular grade of coloring among the many seedlings with fulvous colors now at hand for selection. Wider petals and fuller

flowers would add somewhat to its value as a garden plant, and selective breeding is being carried on to this end.

The hybrid seedling which is now being propagated as the Cinnabar Daylily was one of about 150 seedlings obtained by crossing the old garden clon Luteola with a plant of *H. aurantiaca.* The Luteola Daylily is itself a hybrid, presumably between *H. Thunbergii* and a type known as *H. aurantiaca major.* The seedlings of this particular progeny are, hence, rather complex hybrids, with yellow-flowered and light fulvous-over orange types in their ancestry. As was expected, the flower colors of the seedlings varied greatly. There were many shades of yellow and of orange both in clear colors and in an overcast of fulvous. In Cinnabar the fulvous coloring is more intensified than in the *H. aurantiaca* and this together with other good points makes the plant worthy of general culture.

The above is the first full description and account of origin of the Cinnabar Daylily to be published. A brief mention of the plant was made by the Farr Nursery Company in offering it to the trade in the autumn of 1930.

The New Daylilies Mikado, Wau-Bun, and Vesta

The two daylilies named Mikado and Wau-Bun were described and illustrated in color in a recent number of *Addisonia* (March, 1930, plates 487 and 488). Also mention of these and of the Vesta Daylily was made in *House and Garden* (January, 1929). Hence only a brief statement of their most striking characteristics needs to be made here.

The Mikado Daylily surpasses all other known daylilies in the bold color contrasts in its flowers. In the center of each petal there is a large area of purplish red which is in sharp contrast to the orange colors of the rest of the open flower. The flowers are rather large, full, and widely spreading. The plant blooms during July. In habit of growth it is semi-robust, with scapes almost three feet tall. The appearance of a plant is well shown in

Figure 2.

The distinctive feature of the Wau-Bun Daylily is the unusual form of its flowers. The sepals are large and stiffly and smoothly recurving; the petals are much larger than the sepals, less re-

FIGURE 2. The Mikado Daylily has flowers of striking color contrasts. The large spots of mahogany-red in the petals combine to form an undulating zone of vivid color that is in sharp contrast to the rich orange of the rest of the flower. The flowers are large, full, and widely spreading.

curved, and toward the apex are folded backward along the midrib and somewhat twisted (see FIGURE 3). It is of some interest to note that in the first year of flowering the twisted and folded character was scarcely in evidence. Flowers of that year are shown in FIGURES 2 and 3 of the JOURNAL for August, 1925. The

color of the flowers is light cadmium, slightly sprinkled with faint traces of fulvous red, and abundantly gold-glistening. The combination of color and form gives flowers of rare charm. The plant is semi robust; the scapes are ascending rather than erect; the period of bloom in New York is July. The Wau Bun Daylily has for its ancestry the two species *H. flava* and *H. aurantiaca* and the Luteola Daylily, but it is very distinct from any of these. The same form of flower has appeared in various other hybrids and some of these, together with Wau-Bun, are being used in further breeding.

The Vesta Daylily is a sister seedling to Wau-Bun but the two are so different that the relationship would scarcely be suspected.

FIGURE 3. A flower of Wau-Bun Daylily, showing the unusual form characteristic of this plant.

FIGURE 4. The flowers of Vesta Daylily are full, rich orange in color, and of good size.

Its flowers are full with the sepals and the petals broad and overlapping (see FIGURE 4) and their color is a deep orange with a slight trace of fulvous in the mid-zone. The spread of the open flower is about four and one-half inches. The plant has a compact habit of growth (see FIGURE 5) with scapes only about 30 inches tall. The season of flowering is July.

FURTHER SELECTIONS OF CHOICE HYBRIDS

About fifty different seedlings two or more years old are now under special observation as choice plants. These include a rather wide diversity of types as to size, color, and shape of flowers, season of flowering, and habits of growth. During the coming sum-

FIGURE 5. A plant of the Vesta Daylily. The habit is semi-dwarf and there are numerous flowers.

mer, numerous seedlings will bloom for the first time and these will be compared with the earlier selections. It requires, however, about three years of growth before a seedling daylily reveals its full stature, its habits of growth, and the size of its flowers.

It is the plan during the summer of 1931 to make selections of several plants with flowers of fulvous and red colorings. The seedlings of this class have attracted special attention from all who have seen them.

Thus far the Botanical Garden has not attempted to propagate daylilies for distribution. Each of the selected seedlings is divided and a half is taken by The Farr Nursery Company in exchange for plants of various sorts for use in the Botanical Garden. This company proceeds with the work of propagation until there is suf-

ficient stock to offer to the trade. In the early period of the research, some fifteen years ago, Mr. Bertrand Farr encouraged the writer in his efforts in breeding daylilies and he greatly aided the progress of this work by supplying plants, some of which he obtained from abroad. Of various nurserymen who were approached at that time for aid he was the only one who gave support and sympathetic and constructive advice. The firm which has succeeded to the business established by Mr. Farr has continued to assist in the work and has made liberal exchanges of valuable plants other than daylilies.

There are many "good" seedlings which are not quite "excellent" in grade. It is the plan to assemble these in somewhat naturalistic display plantings in suitable locations in The New York Botanical Garden. This is a matter in which Mrs. Wheeler H. Peckham and Mrs. Harold McL. Turner of the Advisory Council are interested, and it is the plan that they will give attention to the grouping of the plantings according to color of flowers, habits of growth, and season of bloom.

A. B. Stout.

THE FANLEAF-PALM—WASHINGTONIA FILIFERA

Although the western side of North America was formerly much more difficult of access from the Old World than the eastern, early explorations were nearly simultaneous in the two widely separated regions. It may be that the fanleaf-palm was seen by European expeditioners as early in the sixteenth century as was the cabbage-tree of our eastern shores.

On account of the tardiness in the permanent settling of the western coast of America, the fanleaf-palm did not get recognition in American literature nearly as early as the cabbage-tree did. In fact, there seems to be nothing to amount to much until about the middle of the last century.

The references in American literature to the fanleaf palm begin shortly before the middle of the last century. They occur as mere incidental mention of a palm-tree or group of palm-trees in the

landscape. William H. Emory,[1] who was in charge of the expedition referred to in the foot-note below, recorded that:

"A few miles from the spring called Ojo Grande, at the head of the creek, several scattered objects were seen projected against the cliffs, hailed by the Florida campaigners, some of whom were along, as old friends. They were cabbage-trees, and marked the locale of a spring and a small patch of grass."[2]

A few years later in an account of exploration for a railroad route to the Pacific coast, William P. Blake,[3] the geologist of the expedition, records in the three following paragraphs:

"A growth of rushes forms a narrow margin of green vegetation around the spring and its outlet. Willows and mezquite-bushes grow there also; and I found a young palm tree spreading its broad, fan-like leaves among them. The surrounding desert, and this palm tree, gave the scene an Oriental aspect; and the

[1] William Hemsley Emory was born in Queen Anne County, Maryland, 9 September, 1811. Upon graduation from the United States Military Academy he entered the United States Army, in which he served for more than forty years, retiring with the rank of brigadier-general in 1876. His earlier years in the army were spent at various stations in the eastern states, but from 1848 to 1861 he was engaged in exploration and topographical work and border duty, chiefly along the United States and Mexican boundary. It was during this period, and especially while he was in charge of the Mexican boundary commission, 1848–53, that he made important scientific observations and collections, especially botanical ones. During the Civil War he was a general in the volunteer forces, returning to the regular army in 1868. He died at Washington, D. C, 1 December, 1887.—JOHN HENDLEY BARNHART.

[2] Notes on a military reconnaissance from Fort Leavenworth in Missouri to San Diego in California 103. 1848.

[3] William Phipps Blake was born in New York City, 1 June, 1826. He was a member of the first class of the Sheffield Scientific School, receiving the degree of Ph.B. from Yale in 1852. From 1854 to 1856 he was geologist for the Pacific Railroad surveys, and added much to the knowledge of the flora of the parts of California then visited by him, through his observations and collections of plants. In later years his geological work took him to North Carolina, Georgia, Japan, China, Alaska, and Santo Domingo; and he was long professor of geology at the University of Arizona. He died at Berkeley, California, 21 May, 1910. -J. H. B.

FIGURE 1. Groups of fanleaf-palms in a valley near Indio, California, with the upper spent leaves persisting.

similarity was made still more striking by the groups of Arab-like Indians."[4]

"Beyond the camp, and further up the creek, higher bluffs of nearly horizontal strata rose on either side. They were argillaceous, and contained seams of gypsum and concretions, some of the latter being like those seen on the desert. Passed a grove of palm trees, growing at a short distance on the right, the valley being one or two miles wide. The agave or mescal plant and many species of the Cactaceae grow abundantly along the road."[5]

[4] Pacific Railroad Reports 5: 95. 1856.
[5] Pacific Railroad Reports 5: 105. 1856.

"Carrizo Creek to Vallecito, 21 miles. –The water of Carrizo Creek does not appear at the surface for many miles west of the entrance to its valley from the Desert. The greater part of the valley is entirely dry and sandy, and almost as forbidding as the Desert. The monotony is broken by a clump of palm trees on the north of the trail, and a green bank from which springs issue, known as the Palm Springs."[6]

Thus, we see that the fanleaf-palm was a conspicuous object in the landscape in the southern Californian desert and on its edges.

Closely following these records, in a paper entitled, "Additions on Trees and Forests of Florida and the Mexican Boundary" by J. G. Cooper,[7] this note appears:

"Dr. S. Hayes collected leaves of this palm [*Brahea? dulcis?*—California Palm] at Palm Springs, California, but it is not mentioned in any of the Reports on Botany of that region. It has numerous threads along the edges of the leaves, which otherwise much resemble those of the Palmetto. The leaf-stalk is prickly, and the fruit edible. It is used by the Mexicans to make hats, etc., and is a common species in Sonora, where it is said to grow one hundred feet high. Major Emory, Mr. Blake, and others refer to it in their reports."[8] (See above.)

[6] Pacific Railroad Reports 5: 122. 1856.

[7] James Graham Cooper, son of the well-known ornithologist, William Cooper (1798–1864), was born in New York City, 19 June, 1830. He studied medicine, graduating from the College of Physicians and Surgeons of his native city in 1851, and spending two years in hospital work. From 1853 to 1855 he was in the territory (now the state) of Washington, as surgeon and naturalist to the northern division of the Pacific Railroad Survey. In the spring and early summer of 1859 he visited the entire east coast of Florida, from Key West to the St. Mary's River. A few years later he settled in California, which was his home for the remainder of his life. In 1865 and 1866 he was naturalist to the geological survey of the state, but for many years, in spite of delicate health, he supported himself by the practice of his profession. He was perhaps better known as an ornithologist than as a botanist, but he collected plants extensively and made important contributions to botanical literature. Notwithstanding the fact that his health was never robust, he accomplished a vast amount of work, and lived to the age of seventy-two years. He died at Hayward, Alameda County, California, 19 July, 1902.—J. H. B.

[8] J. G. Cooper, Smithsonian Report 1860: 442. 1861.

This, apparently, represents the first attempt to refer to this palm by a botanical name.

Like many other characteristic plants, this palm was long misunderstood, largely because field study was necessary to a proper interpretation of it, instead of closet-study. Herbarium specimens are of comparatively little value in the cases of such bulky plants as palms.

The first attempt, as seen in the last quotation above, resulted in referring it to a Mexican palm, but with both the genus and the species questioned. The second attempt to put it in its proper pigeonhole was a partial success. In 1876 H. Wendland[9] associated it with a genus of palms native in the Hawaiian Islands and the Fiji Islands. However, he did get up courage enough to give a new specific name to the western American palms, and the group appeared as *Pritchardia filamentosa.*[10] The specific name referred to the thread-like fibers along the margins of the leaf-segments—a character common to all of our western American palms, as it is to the several species of our eastern Sabals.

During the same year (1876),[11] Sereno Watson[12] had occasion to refer to this palm and cited it under *Brahea filamentosa,* and in the following year J. Linden[13] published the binomial *Pritchardia filifera.*[14]

[9] Hermann Wendland was born 11 October, 1825, at Herrenhausen, Hanover, where his father was director of the royal garden. He studied botany and horticulture at various gardens in Germany, Austria, and England, became his father's assistant in 1850, and succeeded him as director of the Herrenhausen Garden in 1869. During most of his fifty-two years at this institution he devoted particular attention to the study of palms, upon which he became the leading authority. He died at Herrenhausen, 12 January, 1903.—J. H. B.

[10] Es ist nämlich von Rözl in Nord-Mexico bei Arizona am Rio Colorado eine Coryphine gesammelt worden, welche unter dem Namen *Pritchardia filamentosa* jetzt in den Handelsgärten gezogen wird.—Botanische Zeitung 34: 806, 807. 1876.

[11] Proceedings of the American Academy of Sciences 11: 147. 1876.

[12] Sereno Watson was born 1 December, 1826, at East Windsor Hill, Connecticut. He was graduated from Yale in 1847, spent nine years (1847–56) teaching school and studying medicine (he took no medical degree), and five years (1856–61) in the insurance business at Greensboro, Alabama. At the beginning of the Civil War he returned to Connecticut, and became an assistant in literary work to Dr. Henry Bar-

Wendland continued his studies in the palms, and after an interval of three years realized there was no described genus in which to place this palm and published it as *Washingtonia filifera*.[15]

The new specific name—*filifera*—in this case referred to the same character of the leaf as did *filamentosa* mentioned above.

A dozen years went by, after which another binomial was added to the increasing list by Otto Kuntze,[16] who made the new combination *Washingtonia filamentosa*.[17]

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nard, of Hartford. In 1867 he went to California, and in July of that year entered the camp of Clarence King, then in charge of the geological survey of the Fortieth Parallel, on the Truckee River, Nevada. He remained as a voluntary assistant to the botanist of the survey, who was in poor health, and in March of the following year, by official appointment, succeeded him. Thus, at the age of forty, he first devoted his energies to the science with which his name will always be associated. He had long taken some interest in plant study, but his volume on the botany of this survey at once established his reputation as a scholarly and critical botanist. He became curator of the herbarium at Harvard in 1870, and so continued for nearly twenty-two years. His health was permanently impaired by an illness contracted while on a collecting trip in Guatemala, in 1885, but he continued his active work of study and publication until his death; this occurred at Cambridge, Massachusetts, 9 March, 1892.—J. H. B.

[13] Jean Jules Linden was born 3 February, 1817, in the city of Luxemburg. Before he was thirty years old he had made three plant-collecting trips to tropical America under the auspices of the Belgian government, visiting Brazil, Venezuela, Colombia, Central America, Mexico, Jamaica, Cuba, and the United States. After ten years of exploration, he formed at Brussels an establishment devoted primarily to the introduction of new plants, and sent collectors everywhere. For fifty years he was one of the most notable figures in the horticultural world. He died at Brussels, 12 January, 1898.—J. H. B.

[14] Ill. Hort. **24**: 32, 107. 1877.

[15] Ich schlage für diese bisher als *Brahea* oder *Pritchardia filifera* bezeichnete Pflanze den Gattungsnamen *Washingtonia*, als Erinnerung an den grossen Amerikaner, vor.—Botanische Zeitung **37**: 68. 1879.

[16] Carl Ernst Otto Kuntze was born at Leipzig, Germany, 23 June, 1843. He left school at fourteen, and did not enter upon university studies until nearly twenty years later. He began at an early age the study of the plants of the vicinity of his native city, and his first book, a pocket flora of the Leipzig region, was published in 1867; meanwhile he had been for three years a clerk in Berlin. From 1868 to 1873 he was engaged in the manufacture of volatile oils and essences, and in

FIGURE 2. Groups of fanleaf-palms on a knoll and in ravines near Indio, California, with the lower leaves burned off by fires.

Unfortunately for the nomenclatorial history of this unique but much-named palm, the generic name *Washingtonia* had been previously used in a loose way for other kinds of plants, and six years after the last-mentioned attempt to fix a name on the plant, George B. Sudworth[18] rechristened it *Neowashingtonia,* thus preserving the name of George Washington in the generic designation.

Later in the last century the modern interest in our trees and forests had a beginning. After the fanleaf-palms were better understood further records appeared in more detail.

In a paper on the " Plants used by the Indians of the United States," Edward Palmer[19] records the following information:

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that brief period he amassed a sufficient fortune to retire, devoting the remainder of his life to travel and study. He made two journeys around the world, and at other times visited South America and Africa. He published much on his travels, and on his favorite science, botany. He will always be particularly remembered, however, on account of his book entitled "Revisio Generum Plantarum," in which he attempted a review of the names of plants, proposing to change about twenty-five thousand of those in current use. For many years his home was in Berlin, but during the winter of 1895 96 he removed to a villa at San Remo, Italy, where he died 28 January, 1907.—J. H. B.

[17] Revisio Generum Plantarum 737. 1891.

[18] George Bishop Sudworth was born at Kingston, Wisconsin, 31 August, 1864. He was graduated from the University of Michigan in 1885, and during the following academic year was an instructor in botany at the Michigan Agricultural College. In 1886 he entered the service of the forestry branch of the United States Department of Agriculture, in which, under its successive designations, Division of Forestry, Bureau of Forestry, and Forest Service, he spent the remainder of his life, contributing extensively to the literature of dendrology. He died at Washington, D. C., 10 May, 1927.—J. H. B.

[19] Edward Palmer was born at Hockwold, Norfolk, England, 12 January, 1831. He came to America at the age of eighteen, settling at Cleveland, Ohio; there he made the acquaintance of Dr. Jared Potter Kirtland (1793–1877), who taught him to prepare both zoölogical and botanical specimens, and thus laid the foundation for his long career of usefulness as a collector. His first serious work in this field was in connection with a government expedition to South America, in 1853, and it was then that he acquired his first experience in surgical and medical work; this was supplemented by service as an acting assistant surgeon in the United States Army during and after the Civil War, and earned for him the title Doctor, although he never took a medical degree. Year after year, for nearly half a century, from 1862 to 1910,

" This tree, from forty to fifty feet in height, is not so beautiful as *Brahea armata,* but its fruit is better food, containing more pulp, being much larger and of a more agreeable taste. Cocopah Indians consume the fruit fresh and dry in great quantities; the leaves could be applied to many useful purposes. In the spring the base of young leaves is eaten raw by the Indians. The seeds of both these species of palms are ground fine and eaten, and are not inferior to cocoa-nut."[20]

Referring to *Washingtonia* in the Botany of California Sereno Watson records that the palm grows

" From Southern California (San Bernardino County) to Western Arizona, in rocky localities in dry sheltered canyons, solitary or few in a group. It is now cultivated for ornament in towns near the coast as far north as San Francisco, and has been extensively distributed among the gardens of Europe. The same or very similar species (from which the above description of the flowers is drawn) was found by Dr. E. Palmer in the Tantillas Mountains of Lower California, near the boundary line."[21]

There seems to be no evidence to support the above-cited occurrence of this palm in Arizona. This report seems to be in no way connected with that recorded in the last paragraph of this article.

In an appendix to the same work Watson says further that the palm in question was

" Collected near San Bernardino in May, 1880, by Mr. W. G. Wright, who alone has obtained flowering specimens and whose exertions to this end deserve much credit. He has also received the immature fruit of what may prove to be a second species, said

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sometimes with the army, sometimes for some government department or scientific institution, sometimes upon his own responsibility, he wandered back and forth over the southwestern states and Mexico, gathering rich zoölogical, ethnological, and botanical materials for museums and herbaria. More than a thousand species of plants were described from specimens collected by him, and one genus and at least two hundred species were named for him, during his lifetime. He died at Washington, D. C., 10 April, 1911.—J. H. B.

[20] American Naturalist **12**: 598. 1878.

[21] Botany of California **2**: 211. 1880.

to come from a much larger-sized tree and to be found a hundred miles or more to the east of San Bernardino."[22]

In a work on the North American forests, C. S. Sargent gives its range as

"San Bernardino County, California, from the eastern base of the San Bernardino Mountains to the valley of the Columbia River."

"A tree 12 to 18 meters in height, with a trunk 0.60 to 1.05 meters in diameter, forming groves of 250 to 500 plants in the depressions of the desert, in moist alkaline soil, or solitary and scattered near the heads of small ravines formed by water-courses; often stunted and greatly injured by fire."[23]

Regarding the introduction of the fanleaf-palm into Florida, Robert Ranson writes:

"The first one I believe came to St. Augustine from California in 1881 and was planted in his garden by Holmes Amidown. It grew nicely for about five years. In January, 1886, we had a very severe freeze and it apparently killed this tree. The stump remained in the ground and about July or August of that year it put out a green sprout. The owner let it stand and now (1930) it is the tallest tree in St. Augustine.

"Nothing ever interested me more than *filifera*. I spread plants by the thousands all through Florida in the last decade of the past century, when there were comparatively few in the state—partly by seeds and partly by sprouted plants."

Today the fanleaf-palm is very widely and abundantly grown in Florida and also in the other Gulf States. Present-day Florida with the exotic palm-flora added to the native would be a revelation to the "Florida campaigners" referred to on the second page of this article.

About the beginning of the last quarter of the past century the fanleaf-palms were introduced into the Old World and soon were grown in many of the countries. Much was written about them and soon articles appeared in nearly all the languages of Europe.

The year 1890 ushered in a period of rather lengthy articles, at least too long to quote here, on the fanleaf-palm, written mainly by botanists resident on the Pacific Coast and acquainted with these palms in the field.

[22] Botany of California 2: 485. 1880.
[23] Forests of North America, 217. 1883.

Up to less than a decade ago the two known species of *Washingtonia* were known to grow naturally only in southern California and in Lower California. Then, about 1923, a colony of fanleaf-palms was discovered in a locality, fortunately for their preservation, rather inconvenient of access, in western Arizona; these palms closely resemble *W. filifera* and will prove, upon study, to be identical with that species or to represent another closely related species.

JOHN K. SMALL.

CALIFORNIA WILD FLOWERS[1]

The lecturer, after spending a very short period of time in Nevada as a small boy, went to California and has devoted most of his life to the study of the plant life of that state.

The thing which distinguishes the wild flowers of California when compared with most other portions of the United States is the mass effects of flowers in certain parts of the state. When the speaker went to California in 1870 there were flowers nearly everywhere. In the central valley of California in 1870 you could make a complete circuit of 1,000 miles of wild-flower gardens. As civilization came to California the flowers diminished. Very large areas which were then natural or used only for grazing are now orchards, vineyards, or devoted to other crops. Another reason for the disappearance of the flowers is to be found in the habits of domestic animals. In the early days the sheep were allowed to wander around as in the East, but now, where flocks of sheep are closely herded, there is practically nothing left. The sheep are really destroying a greater asset than their own value and killing out the grasses on the range. The grazing of cattle does much to diminish flowers but sheep are the worst. The third cause is the cutting of the forests, which then reseed very densely. Brush fires and grass fires have been very largely stopped. Great areas of land which were open grassy land in 1870 and 1880 are now dense

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, November 22, 1930, in substitution for the announced lecture on "California Plant Life," by Dr. E. D. Merrill.

areas of brush, so dense that flowers cannot live there. The flowers which naturally love woodlands are not there because the brushland is too new. There is a fourth cause for disappearance of flowers in California. The weeds and some grasses native to the Mediterranean region have come to America and made themselves at home. Foxtail grass first came in little patches, then in dense areas, crowding out everything else. California is practically full of introduced weeds and grasses in certain regions. Some of the ornamental native plants which do not seed rapidly and are naturally uncommon can be exterminated entirely by digging and do need protection. On the other hand, the clearing of forest and brushland in some cases has favored the wild flowers, such as the California poppies and *Brodiaea coccinea,* which are actually spreading.

In 1882 the lecturer made his first trip to the Sierra Nevada Mountains. He went seeking a certain lily, *Lilium Humboldtii,* and was told of a place where it was very plentiful. Here there were about 10,000 of that one lily, because man had stepped in and changed natural conditions by clearing the forest and making open brush land favoring the lilies. In some places civilization will destroy and in others it will stimulate. Some years ago he went with Luther Burbank to a little town where there were 300 acres of Camassias growing naturally in the bed of a drained lake. There were millions of them.

A week later he was in the edge of the Mojave Desert, a region four thousand feet above the sea-level, and stopped in the late evening at a little wayside hotel. In the morning, looking westward, he saw great masses of California poppy. This particular field of poppies was five miles long and it was a glorious sight. Again, in one of the lower deserts, Professor Jepson told him of a lake (when rainy) about eleven miles long, and full of Baerias, a little yellow composite. Sometimes it will be a brush fire that will give the flowers a chance. All of the plants are larger there than they were before, with many more flowers. After clearing and burning redwood lands, the California lilac (Ceanothus) comes up in thousands. In places, one can see just one solid mass of that one shrub. These sights in California are beautiful, but sometimes the meadows of Mt. Rainier in the State of Washington may give even more massive color effects. The kinds of flowers in Cali-

fornia, as elsewhere, are distributed according to conditions of soil and climate. People fail to recognize the extreme extent of the State of California from the humid north to the deserts in the south. We know that in an extremely arid country certain types of plants develop, like cacti and other succulents. Very high in the mountains we have characteristic alpine plants. Near the sea-coast other types of plants develop. The radio-activity of certain soils in California may have some influence in the developing of new species. Soils do have great effects on variation, especially in areas where there are copper and manganese.

California is famous for its flowers and trees. In a certain small area there are nine different species of oak. Nearby there is an iris that grows about six inches high, and for sixty miles one can see no other type of iris. In certain regions their flowers are blue and in other parts the flowers of the same species are yellow. In areas between the two colors, every intermediate gradation of color occurs.

The lecture was illustrated by about seventy-five colored lantern slides.

CARL PURDY.

BOTANICAL EXPLORATION OF THE ISLAND OF HAINAN

An arrangement has been made between Dr. E. D. Merrill, Director-in-Chief of The New York Botanical Garden, and Mr. Woon Young Chun, Director of the Botanical Institute of Sun Yatsen University, Canton, China, for the botanical exploration of the large island of Hainan, lying off the southeast coast of China, with the understanding that the two institutions are to share the collections equally.

This island is about 160 miles long and 90 miles wide, with an area of approximately 14,000 square miles, which makes it nearly twice as large as New Jersey. The present plan provides for exploration for a period of thirteen months by two collecting parties to be organized by Mr. Chun and to give particular attention to the interior mountains and the southern portions of the island, the flora of which is very inadequately known. From twelve to twenty specimens of each number are to be collected

when possible, and these are to be divided equally between the two coöperating institutions.

In the opinion of Mr. Chun, the most promising months for explorations in Hainan are June, July, and August, because nearly all previous collectors have avoided this most trying period of the year, when there are torrential rains and blazing heat and when "the abominable land leeches swarm everywhere." Mr. Chun writes in reference to his own field experience in Hainan in 1920 that "On reaching camp one night, I was surprised to find my stockings clammy with blood—thirty of the loathsome things on my left leg alone, in spite of top boots laced to the knee."

However, Dr. Merrill advises that his experiences in the Philippines proved that an effective protection against leeches could be secured by wearing spiral woolen puttees and smearing the eyeholes of shoes, etc., with ordinary laundry soap. With such simple protection he has traveled for days in tropical forests heavily infested with leeches, without experiencing any difficulties.

Dr. Merrill has already published several papers on the flora of Hainan, his enumeration of Hainan plants, issued in 1927, listing 1,560 species. Dr. Merrill estimates that this number represents not over one half, or at most two-thirds, of the species that actually occur in the island.

A generous contribution from Mr. Henry W. de Forest, President of the Board of Managers of The New York Botanical Garden, is meeting the Garden's share of the expense of this and other botanical explorations in the Orient.

MARSHALL A. HOWE.

NOTES, NEWS, AND COMMENT

Dr. Ernst J. Schreiner, research forester of the Oxford Paper Company, is spending several weeks at The New York Botanical Garden in work on technical problems connected with poplar forestation projects.

The New York Botanical Garden, in coöperation with the University of Nanking and with the Arnold Arboretum, has initiated botanical exploration in China which, it is hoped, can be continued

over a period of five years. Provision has been made for 1931. The coöperative project involves a botanical exploration of the provinces of Shantung, Kweichow, Hunan, Kwangsi, and Southern Kiangsi. The material collected will be equitably divided among the three coöperating institutions.

The regular monthly Conference of the Scientific Staff and Registered Students of the Garden was held on December 10. At this time Dr. Arthur Hollick presented two subjects, "The Upper Cretaceous Floras of Alaska" and "A Late Pleistocene Flora from the Upper Connecticut River Valley." The former paper has been published as Professional Paper 159 of the United States Geological Survey; the latter appears in print in the first number of *Brittonia*. Dr. Forman T. McLean discussed the results of studies of hybrids in *Gladiolus* as to chromosome number and germination of pollen.

Meteorology for January: The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 56° F. on the 4th; 47° on the 6th; 49° on the 18th; 44° on the 26th; and *60° on the 27th.* The minimum temperatures recorded were: 17° on the 2nd; 19° on the 9th; *10° on the 15th;* and 13° on the 23rd. The total precipitation for the month was 2.25 inches. Only traces of snow and sleet fell on the 12th, 19th, 24th and 30th of the month.

ACCESSIONS

Museums and Herbarium

87 herbarium specimens from the Malay Peninsuula. (By exchange with the Singapore Botanic Garden.)

29 specimens of flowering plants from Florida. (Given by Mr. Chas. A. Mosier.)

1 specimen of *Ceratiola* from South Carolina. (Given by Mrs. John R. Tolar.)

204 herbarium specimens from southern India. (Given by Dr. E. D. Merrill.)

1 specimen of *Lycopodium cernuum* from Florida. (Given by Miss Marian S. Franklin.)

17 specimens of flowering plants from California. (By exchange with the University of California.)

1 specimen of *Dichondra carolinensis* from Georgia. (By exchange with Dr. R. M. Harper.)

360 specimens of plants from Sumatra. (Given by Dr. E. D. Merrill.)

155 specimens of flowering plants from Cuba. (By exchange with the Arnold Arboretum.)

200 specimens of flowering plants from Cuba. (By exchange with the Riksmuseum, Stockholm.)

225 specimens of flowering plants from British Honduras. (By exchange with the United States National Museum.)

1295 herbarium specimens from Szechuan Province, China. (Given by Dr. E. D. Merrill.)

587 herbarium specimens of plants from the Caroline Islands. (Given by Dr. E. D. Merrill.)

75 specimens of ferns and flowering plants from Brazil. (By exchange with the Riksmuseum, Stockholm.)

4 specimens of flowering plants from Indiana. (By exchange with Mr. C. C. Deam.)

3 specimens of *Oenothera* from Pennsylvania. (Given by Mr. Geo. E. Osterhout.)

624 herbarium specimens from Hainan, China. (Given by Dr. E. D. Merrill.)

110 specimens of flowering plants from British Honduras. (Collected by Mr. W. A. Schipp.)

23 specimens of miscellaneous fungi from western North America. (By exchange with the University of California.)

67 specimens of flowering plants from South America. (By exchange with the Field Museum of Natural History.)

109 herbarium specimens from Formosa. (By exchange with Mr. Shunichi Sasaki.)

118 herbarium specimens from Assam. (By exchange with Mr. R. N. Parker.)

116 specimens of flowerless and flowering plants from Uruguay. (Collected by Dr. Guillermo Herter.)

175 specimens "Flora Asiae Mediae." (By exchange with the University of Middle Asia.)

100 herbarium specimens from Indo-China. (Given by Dr. E. D. Merrill.)

66 herbarium specimens from Samoa. (Given by Dr. E. D. Merrill.)

8135 specimens of plants from South America. (Collected by Messrs. Killip and Smith.)

75 specimens of ferns and flowering plants from Brazil. (By exchange with the Riksmuseum, Stockholm.)

300 specimens of flowering plants from the Pacific Coast. (Collected by Mr. A. A. Heller.)

60 specimens of woody plants from Cuba. (By exchange with the Arnold Arboretum.)

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Memoirs of The New York Botanical Garden. Price to members of the Garden, vols. I–VI, $1.50 per volume; to others, $3.00. Vol. VII, $2.50 to members; to others, $5.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Vol. VII. Includes New Myxophyceae from Porto Rico, by N. L. Gardner; The Flower Behavior of Avocados, by A. B. Stout; Descriptions of New Genera and Species of Plants Collected on the Mulford Biological Exploration of the Amazon Valley, 1921–1922, by H. H. Rusby; and The Flora of the Saint Eugene Silts, Kootenay Valley, British Columbia, by Arthur Hollick. viii + 464 pp., with 47 plates, 10 charts, and 11 text-figures. 1927.

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JOURNAL OF THE NEW YORK BOTANICAL GARDEN

ALTITUDINAL DISTRIBUTION OF EASTERN AMERICAN IRIS
JOHN K. SMALL

GENERAL PRINCIPLES OF BULB-GROWING
JOHN F. JOHNSTON

BARTON-WRIGHT'S RECENT ADVANCES IN PLANT PHYSIOLOGY
FORMAN T. MCLEAN

NOTES, NEWS, AND COMMENT

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ALTITUDINAL DISTRIBUTION OF EASTERN AMERICAN IRIS

The genus Iris is typically circumboreal and circumtemperate. In the Old World and the New, its species have migrated southward in past geological times with varying success.[1]

The ancestors of our American irises evidently inhabited the more northern parts of the continent. There is no evidence of iris in the past or the present south of our Gulf of Mexico shores.

In North America today the geographic distribution of the genus indicates two insurmountable barriers to further southward migrations—the Gulf Stream on the southeast and the Rio Grande on the southwest. These barriers seem to have been as effective in the more recent geologic times as they are in the present.

Our two original continental plant reservoirs were (1) eastern Canada north of the Great Lakes and the Saint Lawrence River, and (2) the Blue Ridge and Piedmont (with their northeastward extensions), from New Brunswick southward to Georgia. Here the various remote ancestors of our present-day irises presumably existed during the topographic and climatic changes coincident with submergences and ice-sheets. Later additional lands were

[1] Several articles dealing with the irises of eastern North America have been printed in Garden publications within the past six years. They are:
Eight articles in *Addisonia* **9**: 49–64. *pl. 313–32.* 1924.
Eight articles in *Addisonia* **12**: 1–16. *pl. 385–392.* 1927.
Eight articles in *Addisonia* **14**: 1–16. *pl. 449–456.* 1929.
One article in JOURNAL OF THE NEW YORK BOTANICAL GARDEN, **31**: 40–45. 1930.
One article in JOURNAL OF THE NEW YORK BOTANICAL GARDEN, **31**: 237–244, *f.* 1–4. 1930.
One article in JOURNAL OF THE NEW YORK BOTANICAL GARDEN, **31**: 272–277, *f.* 1. 1930.

FIGURE 1. *Iris foliosa* (group Hexagonae, prostrate), growing in The New York Botanical Garden, from plants collected in the type locality in Missouri. In this form the leaves and flower-stalks lie flat on the ground.

formed on the flanks of these areas. Of particular interest in this connection is the Coastal Plain on the south and east of the Piedmont-Blue Ridge strip.

During the Cretaceous and Tertiary, barring minor ups and downs of these land-masses in the making of the continent, the genus Iris had a long and relatively monotonous existence. Then came the Ice Ages. As a result of their influence it appears that the whole plant arrangement from Canada to the Gulf of Mexico was readjusted. Most of the plant life north of Pennsylvania, Ohio, Indiana, and Illinois was wiped out. Many species migrated southward, while numerous others, unable to stand the change of climate and incapable of migrating, must have been exterminated.

If we can judge by the present-day geographic distribution of iris, the primeval species not only managed their retreat, so to speak, exceedingly well but, once started southward, continued until they reached a safe refuge, as far as aerial and terrestrial conditions were concerned, near the shores of the Gulf of Mexico. Of course, it is possible that some species may have migrated southward during the interval between the latest submergence and the advent of northern glaciation, while others may have been driven southward as a direct result of the ice-sheets, and gradually become acclimated along the barrier of the Gulf.

The various primeval species of iris migrated southward chiefly through the highlands, as the lowlands emerged from the sea only gradually during the Tertiary period. After the present approximate elevations of the continent were permanently established, the present species of iris or their immediate ancestors spread out from the Blue Ridge-Piedmont reservoir eastward, southward, and westward.

The contiguous territory of the two plant refuges or reservoirs to be considered underwent different experiences. That surrounding the northern refuge and its vegetation was devastated by ice and cold from glaciation, while that surrounding the southern reservation and its vegetation was damaged mainly by water through submergence.[2]

[2] For information about iris in regions not visited by the writer, we are indebted to Mr. E. J. Alexander, Mr. C. D. Beadle, Mr. B. F. Bush, Dr. J. H. Ehlers, Professor M. L. Fernald, Mr. T. G. Harbison, Professor G. E. Nichols, Mr. E. J. Palmer, Mrs. E. A. Steele Peckham, and Professor E. T. Wherry.

FIGURE 2. *Iris Hookeri* (group Hookerianae), growing along the beach at Mount Desert, Me. In this form the flower-stalk exceeds the leaves. Photo by Edgar T. Wherry.

THE NORTHERN OR GLACIATED PLANT RESERVOIR

The northern primeval plant region (eastern Canada north of the Great Lakes and the St. Lawrence River) handed down to us presumably four irises from the wreckage of the Ice Ages. These represent four distinct groups of the genus, differing markedly among themselves in both inflorescence and in fruit.

(I) One species, *Iris Hookeri* (FIGURE 2)[3], representing a decidedly circumboreal type, has not departed far from its most recent ancestral refuge. From the former highlands the plants have descended to strictly coastal habitats. In eastern Canada and Newfoundland they avoid saline habitats, but follow headlands, sandy or grassy slopes, and other coastwise formations, always

[3] The illustrations with this article represent all groups of the genus in the eastern region.

essentially at sea-level and within sight of, if not actually "a stone's throw" from the sea.

On the contrary, south of the St. Lawrence River watershed, on Mount Desert Island, a different condition obtains. The plants of *Iris Hookeri* are absolutely limited to the salt-spray zone. They seem quite unable to regain any of the ground they lost in descending from the highlands, and are not known to occur more than about twenty-five feet above sea-level on benches cut into cliffs.

(II) A second species, *Iris versicolor* (FIGURE 3), represents a type of iris widely distributed in temperate regions of eastern North America. Its plants in descending from the highlands did not often reach a saline habitat.

In Newfoundland and Labrador the iris plants have descended to within a few hundred feet of the sea. In Maine, since the last

FIGURE 3. *Iris versicolor* (group Versicolores), growing in a bog near Arlington, Vt. In this form the flower-stalks and leaves about equal each other.

FIGURE 4. *Iris prismatica* (group Prismaticae), growing in a bog in northern New Jersey. In this form the flower-stalks exceed the leaves.

ice-sheet withdrew, they have managed to attain (or maintain?) an altitude of two thousand feet on Mount Katahdin and in New York they occur as high as about seventeen hundred feet in the Adirondacks. Then they descend, not only to the "mountains" of Mount Desert (about one thousand feet altitude) but also to the inland limit of *Iris Hookeri.* On a nearby island, Great Cranberry, both *Iris Hookeri* and *Iris versicolor* grow on the inner side of a ridge of coarse gravel (facing inland instead of oceanward), apparently because the sweep of the storms is too strong on the ocean side for any but the toughest plants to hold on. But this ridge slopes down into a salt marsh before the land starts to rise again. In such a place has been collected the first apparent hybrid between these two irises known to science.

(III) A third species, as far as the evidence goes, descended from the highlands only oceanward. *Iris prismatica* (FIGURE 4) has no close relative in eastern North America and forms a group by itself. It is now represented in the lowlands of Nova Scotia and southward along the New England coast, and further southward mainly near the boundary between the Piedmont and the Coastal Plain.

(IV) A fourth group is represented in this northern region by *Iris lacustris* (FIGURE 4A). This species by some chance barely escaped extinction by the ice sheets. In descending from the highlands it seems to have died out in the rear as it advanced, and at present the very dwarf plant is confined geographically to the upper Mackinaw peninsula and the opposite shores of Lake Michigan and Lake Huron. Consequently it occurs only at an altitude of about 500–600 feet. It might be said to have geographic position, but little geographic range.

Among the above-considered species then, *Iris Hookeri* and *Iris lacustris* are now confined to the environs of the northern plant refuge, and seem to have barely escaped extinction through meteoric and geologic changes. Considering the present geographic range of these two species, allowing that for some reason it fell to their lot to be confined to such relatively limited areas, one can understand why they cannot now readily increase their ranges. The dwarf-iris, *Iris lacustris,* is confined to an area drained by Lake Huron and Lake Michigan. The seeds of this species are not adapted to aquatic distribution, and furthermore there are no

extensive migrations of animals, which are the chief agents for distribution in this case, to carry the seeds and plant them in more distant points.

The case of the Canadian species, *Iris Hookeri,* is slightly dif ferent. The seeds of this species are more adapted to water distribution, but the drainage of the areas these plants occupy is either into the lower St. Lawrence River or into the sea.

The two other species, *Iris prismatica* and *Iris versicolor,* considered in a preceding paragraph, evidently had wider geographic distributions in preglacial times, and will be considered further on the following pages.

The Plant Refuge of the South.

The southern primeval plant reservoir was more extensive in area than the northern, and apparently richer in plant forms; at least more abundant materials, so far as iris is concerned, survived there or were later derived from there.

Of the two species mentioned, *Iris prismatica* is represented on the eastern edge of the Blue Ridge at an altitude of about two thousand feet, whence it descends through the Piedmont to the Atlantic Coastal Plain. When the glacial ice retreated, the twin

FIGURE 41. *Iris lacustris* (group Vernae), from near the shore of Lake Huron in northern Michigan. Photo by George E. Nichols.

FIGURE 5. *Iris regalis* (group Roseanthae), growing in The New York Botanical Garden from plants collected near Chacahoula, La. In this form the leaves exceed the flower-stalks.

geographic ranges met and merged toward the sea, so that now this iris grows from Georgia to Nova Scotia. Thus it has extensive latitudinal range, but little longitudinal.

On the other hand, *Iris versicolor* was also apparently common to both ancient plant reservoirs and, being a stronger plant, had more success in its geographic conquest. It gained in longitude as well as in latitude, and has cut through the lowlands both east and west of the Blue Ridge. This species presents an interesting condition, apparently as a result of its ancient experiences: the plants

FIGURE 6. *Iris vinicolor* (group Vinicolores), growing in The New York Botanical Garden from plants collected [illegible] near New Orleans, La. In this form the leaves and the flower-stalks are about equal.

derived from the ancient northern and southern reservoirs exhibit a series of somewhat different characteristics.

The southern primeval reservoir harbored two closely related species, one inclined to a northward distribution, the other inclined to a southward range. They may have been derived from a common ancestor or one may have split off from the other.

The southern type, *Iris virginica* (*I. carolina*), still exists in the Blue Ridge. This plant has left us some indications of its past history. In its biological and botanical histories it resembles *Iris verna,* to be mentioned on following pages. Its botanical type came from the same region as that of *Iris verna*, while the biological type still belongs to the highlands. Its present altitudinal record seems to be about 2,500 feet in the mountains of North Carolina. In descending from the ancient highlands in the Blue Ridge, *Iris virginica* traveled farther than *Iris verna.* Not only did it reach the outer edge of the Atlantic Coastal Plain eastward, but it spread out over a fan-shaped area south of the highlands, even to the Gulf of Mexico, reaching down into the upper part of the Florida peninsula and to the Lake Pontchartrain region in Louisiana. It has maintained its trail through the present Piedmont.

An outlier, *Iris Shrevei* (which may represent a group of species), should be considered here. It is now confined mainly to the Mississippi watershed, but since it combines some of the characters of *Iris versicolor* and *Iris virginica*, this species may well have descended from their common ancestor, even though now growing only remote from the ancestral home.

Although, as far as the present evidence goes, there were no species besides *Iris prismatica* and *Iris versicolor* common to the two preglacial plant reservoirs, the group to which the northern *Iris lacustris* belongs had in the southern region two representatives, *Iris verna* and *Iris cristata.*

The original specimens of one of the three earlier-published American irises, *Iris verna,* came from coastal Virginia. This coastal form of the species represents the botanical type of the species but seemingly not the primeval or biological type. The latter still exists in the present southern highlands, holding in fact the altitude record for iris, at about 4,500 feet on Grandfather Mountain in the North Carolina Blue Ridge. The trail of the species may be traced from this altitude to sea-level, there being dis-

tinct changes in its features as it goes across the Piedmont (between the Blue Ridge and the Coastal Plain). The primitive type descends to an altitude of 1,500 or 2,000 feet, there mingling with an intermediate type, while the botanical type extends from about this same position to sea-level. The resulting geographical distribution takes the form of a semi-circle with the area of the botanical type at the center. It does not extend, however, as far west as the Mississippi River. Northward the species does not stick to the Coastal Plain, but reaches its northern limit on the eastern side of the Susquehanna River in Lancaster County, Pennsylvania, meeting here the geographic range of *Iris prismatica.*

The second species of the group, derived from the southern highland, *Iris cristata,* now at least has less altitude but covers more area than *Iris verna.* Its biological type so far as known attains a maximum altitude of about 2,500 feet in the Blue Ridge. Unlike *Iris verna,* which maintained altitude but spread relatively little in area, *Iris cristata* apparently lost some of its primeval altitude but made extensive areal gains. From the ancient highlands the latter species traveled oceanward, and also to Maryland and Ohio on the north, Florida on the south, and Missouri and Arkansas on the west, occupying roughly a vast elliptical area. West of the Mississippi River the species reaches an altitude of about 1,500 feet on the Ozark Plateau. It seems strange that neither *Iris verna* nor *Iris cristata* has gained more latitude northward since the Ice Ages. However, this condition may result from the east, west, and south drainage basins, there being very little drainage northward.

The wider geographic range and consequently more varied experiences of the recent ancestors of *Iris cristata* have resulted in a larger number of local variations than in the case of *Iris verna,* and plants from the various regions show rather strikingly different features of coloration and shape and size of certain parts.

The ancient and modern highlands have given away, as it were, many more irises than they have retained. Only the few species thus far mentioned now exist on or near the ancient highland areas. Many other species of iris grow at present in the Coastal Plain completely separated from the Blue Ridge by one or more intervening provinces or subprovinces. The ancient migrations from the highlands have resulted in the depositing or developing

FIGURE 7. *Iris tripetala* (group Tripetalae), growing in flatwoods between Weewahitchka and Port St. Joe, Florida In this form the flowerstalks equal or exceed the leaves.

of a half dozen distinct groups of iris in the Coastal Plain since the latest general submergence of the land. Not only are these numerous species of iris now cut off from their ancestral home, but they exist for the most part in the outer zones of the Atlantic and Gulf Coastal Plain.

One of these "lost tribes," so to speak, is a unique plant of the southeastern states, *Iris tripetala* (FIGURE 7). Its range is strictly limited to the Coastal Plain. It must have had considerable additional distribution in former times, but after it migrated from the highlands which it occupied during the submergence of the territory it now occupies, it died out in the rear. Today we find it growing mostly near the coast itself, eastward to the Atlantic and southward to the Gulf of Mexico in two or more forms. It has superficial resemblance to *Iris Hookeri* in its three small, sometimes almost rudimentary petals.

Another of the "lost tribes" may be typified by *Iris hexagona* (FIGURE 8). At least this species is the historical botanical type of this group. Since the advent of its ancestors in the southeastern Coastal Plain this group of two species, *Iris hexagona* and *Iris rivularis,* has maintained itself in a rather restricted range.

Likewise a migration to the Mississippi Valley resulted in another group of two species, *Iris foliosa* and *Iris flexicaulis,* the former now growing at a maximum altitude of about 750 feet in the Missouri River bottoms.

Passing into the Florida peninsula and the Apalachicola delta, we find a very interesting "lost tribe" of three members, different again from any of those heretofore considered and also further removed from the ancient plant reservoirs. The one, *Iris savannarum,* is very abundant in the peninsula, ranging from about 50 feet of altitude in the Lake Region and adjacent provinces to near sea-level. Another species, *Iris Albispiritus* (FIGURE 9), shows a similar behavior, except that it is rather less wide-spread, less abundant, and does not grow quite so high above the sea. The third will be referred to in a later paragraph.

Curiously enough, so far as we know, not a single iris has been found within the boundaries of the Everglades proper. Large colonies of *Iris savannarum* occur on the Okeechobee prairie just north of Lake Okeechobee and in hammocks and on small prairies between the head of Okeechobee and Fort Pierce on the eastern coast. It seems strange that iris does not occur further southward in the lowlands flanking the eastern side of the Everglades. The northward trend of the basin about the headwaters of the St. Johns River, which begins about the latitude of the northern limit of iris on the eastern side of the state, may be the governing factor.

On the western side of the state the superficial drainage tends southward through the Big Cypress Swamp, and there iris makes its southernmost record in the New World. Two species are here concerned, *Iris savannarum* and *Iris virginica.* According to our present information, the latter species has a slight advantage over the former, occurring as it does in the Big Cypress Swamp in about the latitude of Miami or in about the same latitude as the mouth of the Rio Grande on the opposite side of the Gulf of Mexico.

FIGURE 8. *Iris hexagona* (group Hexagonae, erect), growing in a cypress swamp near the Steinhatchee, Florida. In this form the leaves exceed the flower-stalk.

FIGURE 9. *Iris Albispiritus* (group Violanthae), growing in flatwoods near the Caloosahatchee, Florida. In this form the leaves and flower-stalks are about equal.

So far, the species of iris considered are all represented on the Atlantic seaboard, although several of them also enter the eastern gulf coastal region. The delta of the Apalachicola River harbors an ancient immigrant with its past history wholly obliterated, for it is now separated from any close relations. This is *Iris Kimballiae*, the third member of the group to which *Iris savannarum* and *Iris Albispiritus* belong. Its only generic associate is *Iris virginica*, a species of quite a different group of the genus, and its maximum altitude is only a few feet above sea-level.

Passing westward, we find the iris development in western Florida, southern Alabama, and southern Mississippi relatively meager. Colonies of *Iris virginica* are most abundant, but they occur, nat-

urally, only a little above sea-level. A "blue"-flowered species, the botanical relationships of which are not yet fully understood, grows at sea-level on the flats of the Mobile River, apparently further inland, and along Bay St. Louis. As soon, however, as the lower delta of the Mississippi River is reached, one finds himself in perhaps the most remarkable local development of species of iris in the world. South of the latitude of Lake Pontchartrain and thus almost at sea-level there are growing naturally more than fifty species of iris, represented by scores of varieties. From the

FIGURE 10. *Iris fulva* (group Fulvae), growing in a small bayou near Chacahoula, Louisiana. In this form the flower-stalk much exceeds the leaves.

standpoint of altitude there is nothing to be said about these, however, for only one of the numerous species reaches any appreciable elevation above sea-level. *Iris fulva* (FIGURE 10), forming a group quite distinct from all the others thus far discovered, eventually attains an altitude of about 400 feet in the higher provinces of Arkansas and Missouri.

The more recent geologic history of iris in eastern North America, through circumstantial evidence, indicates great changes in geographic and altitudinal distribution and locally great slaughter of species. In all, about fifty species of iris are known to be native between the Atlantic Ocean and the Mississippi River. The ancestors of these species, direct or indirect, must have, in more recent geologic times, existed in the ancient highlands—the present Blue Ridge and eastern Canada. Else they could not have survived the general submergence of the less elevated parts of the continent. After the land surface had become more stable, these ancestors began to migrate into the lowlands. Some of the present-day surviving species have left trails that can be followed, but the great majority of them have left no indication of their descent from the ancient plant reservoirs. For example, only five species (*Iris virginica*, *Iris versicolor*, *Iris prismatica*, *Iris cristata*, and *Iris verna*) now show a geographic continuity from the mountains to the coastal regions. All these species finally reached the Atlantic Coastal Plain, while *Iris virginica* and *Iris cristata* also reached the Gulf Coastal Plain and *Iris cristata* crossed the Mississippi basin and spread into the present highlands of Arkansas, Oklahoma, and Missouri.

There are evidences of primeval changes and destruction in and about the ancient highlands. But it is when we consider the remarkable iris development in the lower Mississippi River delta that the ancient wholesale destruction is emphasized. Where did these many species come from? They or their ancestors moved of necessity down from the highlands, though not a trace of them remains there. Nature has completely obliterated the course of their migration.

JOHN K. SMALL.

GENERAL PRINCIPLES OF BULB-GROWING[1]

There is a peculiar charm and intense interest in the growing of bulbs, whether in the garden, in the conservatory or in the home. To watch their growth is fascinating.

Bulbs are planted in the garden in the fall months. They are nurtured in the lap of Mother Earth while the cold blasts are blowing above them. Then, no sooner does winter give way to the heralds of spring, than the shoots of the bulbs peep forth from the ground, to blossom soon in all their colored glory.

On the whole, bulbs are not difficult to grow, as they are not so fastidious in their requirements as many other plants. In most cases the amateur can grow them just as well as the professional gardener. Still, they produce the finest flowers when the best of cultural care is given them.

The bulbs commonly known as "spring-flowering" are usually the narcissi or daffodils, tulips, hyacinths, crocuses, scillas, etc. Most lilies flower later.

To have the finest blossoms, start right by obtaining the best bulbs. They may cost a little more but they will pay in better results.

The soils best suited for bulbs generally are those of good loamy texture with considerable sand in them. Retentive or heavy soils can be made suitable by incorporating liberally of leaf-mould, not too rotted, and sand. For enrichment, spade or fork well-rotted barnyard manure and bone meal into the soil.

Autumn is bulb-planting time; October and November are the best months in this neighborhood during which to plant. There is danger in too early planting, as the bulbs will start to grow and come to the surface of the ground, exposing themselves to chilly blasts and sudden frosts. Tulips are prone to this early growing, and so this danger must be avoided.

If you are not ready to plant your bulbs when you get them, keep them in a cool airy place and spread them out to avoid what is termed "sweating" or heating. Many good bulbs are spoiled through sweating.

[1] Abstract of a lecture and demonstration given at The New York Botanical Garden on Saturday afternoon, December 13, 1930.

"How deep should bulbs be planted?" is a question often asked. There can be no hard and fast rule governing depth of planting. It must naturally vary according to the kind of bulbs. Tulips, hyacinths and daffodils should be planted deeper than crocuses, scillas and snowdrops. Lilies are planted still deeper than any of these. On the whole, it is safest to plant fairly deep. From three to six inches is a good general depth.

When the bulb is placed in the hole made by the trowel or spade, make sure that it is pressed down firmly and that it touches the bottom of the hole to avoid what is known as "hanging."

After planting nothing needs to be done till winter has frozen the ground hard; then a mulch or covering of rough litter or leaves should be applied. The purpose is to keep the ground frozen, and so prevent alternate freezings and thawings, which might otherwise break or wrench many of the roots. This mulch must be removed after the frost has gone from the ground, and you now watch expectantly the development of that floral picture to which, no doubt, you have eagerly looked forward.

When the flowers have faded or the petals have begun to drop, cut off the seed pods, for, if allowed to mature, they sap the vitality of the bulbs. Afterward let the foliage ripen and die down. If the ground is needed for other purposes before this dying down takes place, the bulbs should be lifted carefully, with as many roots attached as can be saved, and then planted or "heeled in" in some vacant spot to ripen. Then lift, dry, and store away in a cool airy place till next planting time.

Daffodils do not seem to deteriorate or "go back" as much as tulips, if allowed to remain in the ground all through the year.

Such is the general culture of bulbs in the garden.

Planting schemes for color effects is a large subject in itself, opening up a wide field for originality of ideas and personal tastes, but, whatever plan you adopt, the great joy is in arranging your own floral picture, and watching it unfold from day to day. It may not measure up to your fondest expectations—and again it may; but that is gardening, and therein lies its interest.

The growing of bulbs in the conservatory and in the home is a fascinating pastime. All of us cannot own conservatories, or even gardens, but we can all experience the pleasure of raising a few

bulbs in our homes. The children can do it and get delight and education.

Many forms of receptacles may be used, and much artistic ingenuity can be shown, especially since, whether pot, pan, box, bowl, glasses, or even large shells are used, the culture of the bulbs is not intricate. Really, in most cases it is quite simple. Tulips, daffodils, hyacinths, and other kinds can be easily grown at home in such containers.

The material for the roots to grow in may be soil, moss fibre, pebbles and water, or water alone. The great aim toward success, no matter what is used as a rooting medium, is to encourage the best root development before the shoot begins to grow. Failure to do this results, in most cases, in considerable disappointment.

Bulbs to be grown indoors are best potted earlier than those planted in the garden. If pots, pans, or boxes are to be used, soil is the best medium for the roots; if bowls or other fancy containers, use what is known as bulb-fibre, or pebbles, and water.

All bulbs should be given as long a time for rooting as possible. Plant each bulb firmly. Care should be taken not to plant the bulbs too deeply; in fact, the crown of the bulb should just come to the surface of the material in the container.

Newly planted bulbs should never be placed in a strong light, as this will encourage the shoots to grow before the roots are developed—a thing to be carefully avoided. They should be stored away in a darkened room, shed or unheated cellar and allowed to remain there until well rooted. Then they should be brought gradually into a stronger light.

The inexperienced will have greatest success, likely, in growing narcissi or daffodils. Tulips are not difficult, but hyacinths are somewhat more so. However, there will be little difficulty with any if sufficient care is taken and the bulbs are not over-watered.

Start with growing a few, and the pleasure derived will impel you to grow more.

JOHN F. JOHNSTON.

BARTON-WRIGHT'S RECENT ADVANCES IN PLANT PHYSIOLOGY[1]

The author undertakes a critical review of the important literature of plant physiology from 1918 to 1928. It is unfortunate that, having selected a limited number of papers which he considers important, he gives incorrect references, sometimes omits the reference entirely, and, in an occasional case, even incorrectly states the conclusions. This, and his strong preference for chemical rather than physiological evidence, in some instances lead him to decidedly biased conclusions. Despite obvious errors of this sort, the book is an interesting review of the recent work in plant physiology and has considerable merit.

The subject-matter is handled in six large chapters. In the treatment of soil and water relations, undue emphasis is given to lignin-decomposition as a probable source of humus in soils. Since this is research work of the author, it is not surprising. Soil acidity is also treated extensively, but here Blair and Prince are incorrectly cited, and their work and that of others on the toxicity of aluminum in acid soils is ignored in favor of purely chemical work on the probable occurrence of dissolved aluminum in soils. The discussion of aeration, root distribution, absorption, and antagonism seems to bring out the salient facts.

In the second chapter, the discussion of transpiration is detailed, as is that of the ascent of sap. The discussion of Dixon's cohe sion theory brings out many of its weak points, but fails to mention the work of Copeland, published in Pfeffer's Festschrift in 1916. Copeland there disposes of any necessity for the cohesion theory!

The third chapter, on carbon assimilation, devotes undue attention to the problematical first product of photosynthesis, and passes over such fundamental work as that of Spoehr with brief comment.

The fourth chapter, on nitrogen assimilation, again reveals interesting deductions regarding organic chemistry and a relative slighting of plant physiology. Most of the ample literature on nitrogen absorption is entirely ignored, while detailed accounts are

[1] Barton-Wright, E. C., Recent advances in plant physiology. Pp. xii + 352. 51 *f.* P. Blakiston's Son & Co., Inc., Philadelphia, 1930.

given of the supposed chemical changes which may take place between the organic compounds found in plants.

His discussions of respiration (chapter 5) and the physiology of growth (chapter 6) are rather fuller, though in the discussions of the elements needed there are conspicuous omissions of important contributions.

Considered as a whole, the book is an interesting assemblage of selected portions of the recent literature on plant physiology. Since it does not in most cases attempt truly to evaluate these, it might well have been made more complete in covering the literature as a whole.

FORMAN T. MCLEAN.

NOTES, NEWS, AND COMMENT

Mr. Robert Hagelstein, Honorary Curator of Myxomycetes, sailed February 11th for a three weeks' visit to Trinidad and Barbados, where his time will be devoted chiefly to collecting Myxomycetes and diatoms.

Prof. Ignatz Urban, the second Director of the Botanical Garden and Museum at Berlin-Dahlem, died on the morning of January 7, the 83rd anniversary of his birth. Dr. Urban was well known to the systematic botanists of America as the author of "Symbolae Antillarum" and other important papers dealing with the flora of tropical America.

Professor F. A. Varrelman, head of the Department of Biology of the American University at Washington, is spending several months at The New York Botanical Garden in a study of the navel type of apple as to the relation of its development to seedlessness and parthenocarpy. This type of fruit is very similar in structure to the navel orange and it seems possible that it may be of value in breeding for the development of seedless apples.

Dr. E. D. Merrill has recently presented to the library of The New York Botanical Garden two Wedgewood medallions, one of Sir William Jackson Hooker, Director of the Royal Botanic Garden at Kew from 1841 to 1865, and the other of his son, Sir Joseph Dalton Hooker, who was Director of the same famous gardens from 1865 to 1885. These medallions were prepared

from the original dies of earlier date in connection with the Fifth International Botanical Congress held at Cambridge, England, last August, at which Dr. Merrill was one of the five delegates representing The New York Botanical Garden. The various excursions arranged for visiting delegates before, during, and after the Congress included a pilgrimage to Halesworth Church, in Suffolk, for the dedication of a memorial tablet to Sir Joseph Hooker, born at Halesworth, and Sir William, who lived there for a number of years.

During the summer of 1929, Dr. Fred. J. Seaver, Curator, in collaboration with Mr. Paul F. Shope of the University of Colorado procured, in their collection of fungi, a large number of rusts from the mountains and the plains of Colorado, Wyoming, and South Dakota. During the period of August 1–4, they were assisted by the mycologists of the summer meeting of the western branch of the Botanical Society of America.

When the rust collections were later studied and determined by Drs. H. W. Thurston and F. D. Kern of Pennsylvania State College, the records showed eleven host plants new to North America, one new for Colorado, nine new for Wyoming, and seven new for South Dakota, while six of the rust species are reported from their respective localities for the first time. Seven duplicate sets of these collections were made and one deposited in each of the following institutions: Harvard University; Iowa State College; the University of Colorado; the University of Wyoming; the University of Toronto; Pennsylvania State College; and one with Professor A. O. Garrett, the rust specialist at Salt Lake City, Utah. Each set contained 91 specimens, making in all an exchange of 658 specimens. A detailed account of this rust collection was published in the January-February issue of *Mycologia.*

Meteorology for February. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 60° F. on the 6th; 50° on the 14th; 50° on the 22nd; 60° on the 24th; and *61° on the 28th.* The minimum temperatures recorded were: 14° F. on the 1st; *11° on the 3rd;* 12° on the 15th; 25° on the 21st and the 28th. The total precipitation for the month was 2.38 inches. Three inches of snow are figured in this total as .30 inches of rainfall. Traces of snow were noted on the 2nd and the 10th.

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 41,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
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PLANT HYBRIDS[1]

Plant hybrids have recently received a signal recognition in the eyes of the law of our land. By enactment of Congress, they may, with certain restrictions, be patented as new plants. In the future, the person who has "invented or discovered" a new plant and has propagated it asexually, except by tubers, may be granted a patent which gives him control of its propagation and sale for a period of seventeen years. Presumably a "new plant" may be of a wild type not hitherto known, a new variation of a species or variety already in cultivation, or a hybrid.

The matter of plant patents is of special interest to plant breeders who are concerned with producing new plants of value for culture, to nurserymen who propagate plants for sale, and to every one who grows such plants for pleasure or profit. The tree, bush, vine, and small fruits, the tree and shrub ornamentals, and the herbaceous perennials of the flower garden were all *once* new plants; most of them are propagated vegetatively; and in the development of many of them hybridization and selective breeding played an important rôle. Such plants are now to be considered as inventions.

This situation naturally gives additional stimulus to the popular interest in plant hybrids and in plant breeding—an interest that has already become very general in connection with the remarkable advance of knowledge during recent years regarding the processes of reproduction and heredity in both plants and animals. Popular interest in plant hybrids is centered in the following questions:

[1] Abstract of an illustrated lecture given at The New York Botanical Garden, November 15, 1930.

(1) What are hybrids?
(2) How are plant hybrids produced?
(3) What practical uses have plant hybrids?
(4) How is it possible to obtain new types of plants by hybridization? And
(5) What do plant hybrids reveal regarding inheritance?

Fortunately the essential facts involved in the answers to these questions are now well known and they may be understood or at least recognized by almost any one.

A hybrid may be defined as the offspring of two parents which belong to different species or to different races or strains of the same species. In many groups of plants and animals, any two parents are almost certain to differ in one or more minor respects; but usually the offspring are not called hybrids unless they have descended from parents which belong to rather distinct groups of individuals and which differ in one or more well-defined characters.

Hybrids are made possible by the normal processes of fertilization and sexual reproduction as a result of which a plant as well as an animal may have two different parents. With the higher or flowering plants these processes lead to the formation of seeds, and so to understand hybrids one must know the essential facts regarding the origin and the nature of a seed.

It has long been observed that seeds are to found within fruits and that within a seed there is a minute plant which may grow into another mature plant. What a seed is and how it arises have long been matters of much speculation. For ages man thought of the seed as an internal bud similar in nature to the buds on branches. As long as this idea prevailed there could be no really scientific breeding of plants, for there was no conception of the rôle of the male parent in reproduction or of its influence on the offspring, and there was no adequate control and selection of the male parent. This became a part of the methods of plant breeding only when it was realized that the tiny plant or embryo in the seed really has two parents and is itself a dual or diploid organism. This fact first became well known, at least generally, within the lifetime of persons now living.

The sequence of steps in seed reproduction may be stated as follows: Flowers bear spores of two kinds. The familiar pollen

grains shed from stamens are microspores, which are widely distributed by insects and air currents, and by such means some of them may lodge on the stigmatic ends of pistils -a process called pollination. Within the cavity of the enlarged and basal portion of the pistil in flowers are small sacs (ovules) in each of which is a single large spore (macrospore). This spore is not liberated but grows within the ovule to form a group of delicate cells, one of which becomes an egg cell. Meanwhile, if pollination has been properly effected, slender tubes grow from the pollen grains, penetrate through the pistil, and enter the ovules, where they burst and liberate male sperm cells. The fusion of a sperm with an egg in the ovule is the final stage of fertilization. Thus the fertilized egg cell is two cells combined in one cell; it is a dual or diploid cell. From this one diploid cell the embryo develops by repeated cell divisions which continue and extend the diploid condition to all parts of the embryo and later to all parts of the plant which it may become.

It is possible with the use of modern methods of microscopic technique actually to observe the dual nature of the cells of a plant and to trace how this condition arises in fertilization. Each cell of a plant is found to be a complex mechanism with different parts, among which are definite bodies or packages of germ plasm called chromosomes. These are usually uniform in number in all cells of a given plant and they may be observed in the stages of growth and division. When a cell divides, each chromosome also divides into two sister chromosomes, one of which goes into each new daughter-cell. A chromosome has the power of growing and dividing into two parts, each like the original.

Normally, half of these chromosomes in the cells of a plant come from the seed parent through the egg and half come from the pollen parent through the sperm cell of the pollen tube. With them come also plasm with other elements of living material. Thus two groups of living material become intimately associated in the one cell and they coöperate in the activities of the many cells that arise from it by division, and these parental elements interact in the expression of characters in the new plant which these cells build.

Thus the microscopic study of the actual structure of the plant shows that most of the qualities which one observes in the plant

do not exist as such in the individual cells. Some characteristics like green coloring in leaves and the various red and yellow pigments in variegated leaves and in flowers are developments within the cells and are very closely associated with special parts of them. But qualities which belong exclusively to organs composed of many cells are directly represented in the spores and all the body cells of the plant by units of living material that are transmitted from generation to generation.

To state the matter another way, some of the different units of living material are able to do different kinds of work, and this may be so specialized that only one minute unit of germ plasm is able to do a particular piece of work. But numerous cells coöperate in the production of mass or general characters, such as size and shape of flowers.

When the plant is a hybrid its dual nature brings into play differences in certain of the units of the living structures which operate the machinery of the cells and which determine such expressions as color and size of flowers, size, color, and quality of fruit, shape of leaves, and habit of growth.

One further process must be considered if the essential nature of reproduction and hybridization is to be understood. When the spores are produced in the stamens and the pistils of plants a special and very complicated kind of cell division occurs which reduces the number of chromosomes by half. As a result of this the spores contain, normally, half as many chromosomes as the plant which produces them. This number is called the haploid number. During this reduction-division the general rule is that the chromosomes are associated in pairs and that then one of each pair are reassembled in all possible combinations in the spores. The possibilities of such a process may be considered in a simple case of a plant with only six chromosomes in each cell; *A. B. C.* from one parent and *a. b. c.* from the other parent. When the spores are formed there can be eight kinds of spores with respect to the ensemble of individual chromosomes which they possess:— *A. B. C; A B. c; A. b. c; a. B. c; a. b. C; a. B. C; A. b. C;* and *a. b. c* In two of these the combinations are those of the two parents; for each of the other assortments there is one chromosome from one parent and two chromosomes from the other.

In this way a complete set or series of chromosomes is, under fully normal processes, obtained by each spore and sex cell. Then

fertilization brings two sets together during the life of the next generation. The number of different assortments in a set and the number of different recombinations in the two new sets will depend on the differences which existed in the pairs of the two parental sets. If the two members of each pair are alike and $A \cdot a$, $B \cdot b$, and $C \cdot c$, then all the spores and the sex cells are alike and equal to $A\ B\ C$. If a difference exists in one pair only, then two kinds of spores will be produced and three recombinations between them are possible. If there is a difference in each of two pairs, then four kinds of spores are produced and between these nine different recombinations are possible. If all these pairs possess at least one difference in each pair, eight kinds of sex cells are possible and in free matings twenty-seven different kinds of recombinations are possible between them.

Usually the number of chromosomes in a set is more than three and each chromosome carries more than one hereditary determiner. Also a single character may be the expression of an interaction between a large number of different elements of germ plasm. In many cases hybridization involves differences in several or even in all of the chromosomes and the diversity among the offspring is great.

And thus the variations that appear among hybrid plants depend chiefly on the kinds of germ plasm units which exist in their cells, and these may be traced back through the recombinations in fertilization to the assortments of reduction divisions when spores are formed by the parents. The process of pollination hence becomes a very important stage, for it makes possible not only natural cross-pollination but also a control of parentage in the work of experimental hybridization and selective breeding.

Through the cross-breeding of individuals differing in one, two, or more characters, following the methods inaugurated by Mendel in his famous experiments with garden peas, much has been learned about heredity. In fact, the vast accumulation of data regarding inheritance that has been obtained in recent years has been thus derived. The hereditary behavior of contrasted characters is tested by cross-breeding which is followed by pedigreed cultures of at least several lines of descent. When the parent plants are bisexual, the self fertilized offspring of each may be grown for comparison. By such methods the various laws of in-

FIGURE 1. Showing methods employed to control pollinations in the cross-breeding and the self-breeding of various vegetable crops. Photos by courtesy of the Ferry-Morse Seed Company.

heritance in plants have been formulated and are still being determined and studied.

When a flowering plant is bisexual and produces perfect flowers, there is a possibility that its seeds may be formed from self-pollination, in which case both the male and female elements concerned in fertilization and in the development of the embryo are provided from the flowers of the one plant. But in nature there are many provisions and adaptations for promoting or even compelling pollination from another plant, and thus it happens that the seedlings of many plants have two different individuals as parents, although, perhaps, in the majority of cases these are members of the same variety. But many natural hybrids are to be found among wild plants when two species or two strains of the same species are growing together under conditions that promote cross-pollination. For example, many natural hybrids in oaks exist in certain localities in northern New Jersey and elsewhere. The wild rose-mallows, conspicuous on account of their large gaily-colored flowers in the swamps about New York City, present a medley of colors due to natural hybridization that has been in progress for years. Hybridization occurs rather freely in nature and evidently it may be one of the methods by which new types of plants evolve.

By controlling pollinations and thereby influencing the fertiliza tions in the flowers of plants, the parentage of seedlings may be determined and controlled at the will of the experimenter or plant breeder, subject to the limitations which exist in the extent to which such fertilizations will occur. The general rule is that plants and animals which are widely different will not cross-fertilize and hence it is not possible to obtain hybrids between most types of plants. Oaks will not hybridize with walnuts, or roses with apples; some roses will not cross with certain other roses. Such limitations are of importance in preserving diverse types of life. Yet within related groups of plants much hybridization is possible both in nature and under artificial treatment. Also, in the work of plant breeding types of plants that are widely separated in nature may be brought into the experimental garden and utilized in hybridizations that may never occur naturally.

In general, the results of hybridization fall into five main classes:

I. No new qualities appear and the hybrid progenies are no different from the parents.

II. No new characters appear but certain characteristics of the two parents are combined in some of the bybrids.

III. A new quality appears in the first generation of the hybrids and this is continued in certain lines of descent in later generations.

IV. No distinctly new characteristics appear, but the individuals of the second generation exhibit many gradations or "quantitative variations" between the extremes of the two parents.

V. New characteristics appear and at least certain of the hybrids are decidedly different from the original parents. In some cases a new fertile race of plants is produced.

In illustrating these types of results to be obtained from hybridization it will be best to consider contrasts in a specific character or a quality of a character by which the parents differ.

I. Where No New Qualities Appear

Hybridization that produces no change in the appearance of plants may be illustrated in the moth mulleins (*Verbascum Blattaria*) which grow wild about New York City. Some plants have yellow flowers and breed true to this characters; others have white flowers and breed true to this character. The hybrids between these two types are yellow flowered and look exactly like the yellow-flowered parent, but when their own offspring (the F_2 generation) are obtained they are yellow-flowered and white-flowered in the ratio of approximately 3 to 1. Of these, the white-flowered plants and one out of three of the yellow-flowered plants breed true to their own flower colors; the others give offspring in the 3 to 1 ratio as do the F_1 hybrids.

This behavior in hybridization is readily understood. These moth mulleins have as many as 32 chromosomes in the two sets, but the hereditary differences in respect to flower color are carried in only one pair and the other pairs are practically alike. In respect to flower color, the yellow-flowered plants are *YY* in composition of germ plasm and the white-flowered are *ww*. In representing the kinds of germ plasm by letters, capitals may be used when a quality is dominant in expression and small letters when it is recessive. When fertilizations between these two types occur, *Y* pairs with *w* and the hybrids are *Yw*. But the germ plasm which produces yellow proves to be fully dominant and no influence is seen for the germ plasm carrying white. These hybrids

produce two kinds of spores and sex cells, some carry Y, others carry w, and when the hybrids are self-fertilizated the recombinations in the offspring are YY; 2 Yw; 1 ww. Thus three of the F_2 are yellow-flowered to one that is white flowered. The various processes and conditions involved in this hybridization may be illustrated in the following diagram:

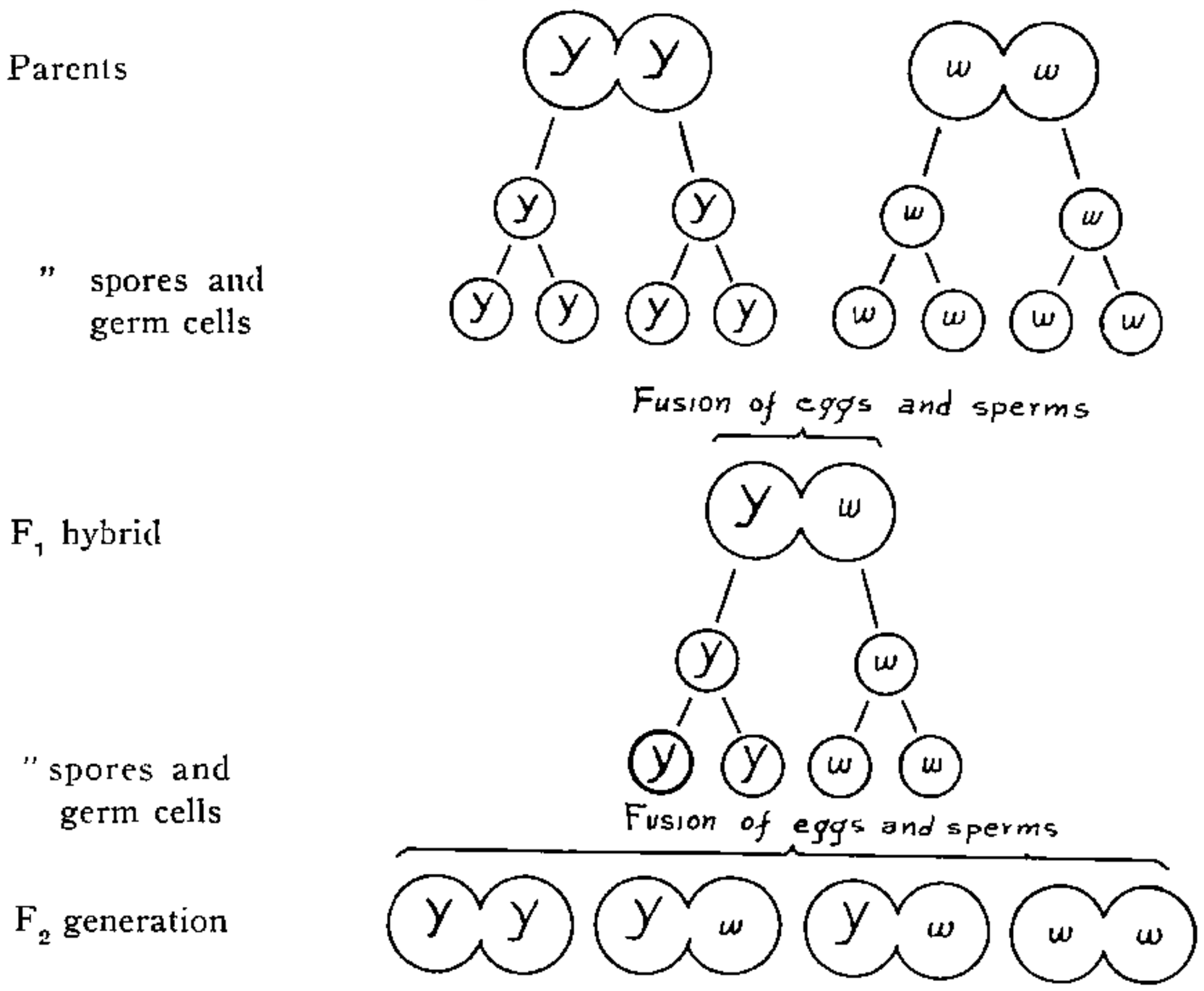

FIGURE 2. Diagram illustrating the operation of the mechanism of inheritance of flower color in hybridizing yellow-flowered and white-flowered races of moth mulleins (*Verbascum Blattaria*).

Several "Mendelian" laws of inheritance are here illustrated. In the hybrids there is *dominance* of one of the contrasted hereditary units (for yellow) over the other (for white) which is called *recessive*. There is segregation of the contrasted units of germ plasm when spores are produced and there is chance recombination in the next fertilizations. There is purity in the segregation of the germ plasm units, for the white-flowered plants of the F_2 breed true and their units of germ plasm show no change or influence from being associated with the germ plasm which determined yellow. Also, as far as is now known, the hybrid com-

position *Yw* may be kept in existence for innumerable generations and still the factor for *w* will reappear or segregate with purity. Thus certain white-flowered plants may appear which have had only yellow-flowered parentage for many generations! One point of special practical significance is well illustrated in these results and that is that two plants which look alike may be very different in germ plasm composition and may hence give different kinds of offspring. Also plants that are white-flowered may have either white-flowered parents or certain yellow-flowered parents.

II. Traits of Parents Combine in Hybrids

By hybridizing parents which differ in two different characters, new combinations of characters may be obtained in a plant although there may be no changes in either pair of characters. This may be illustrated by the results which may be obtained with garden peas. A variety which breeds true to *round* (starchy) and *green* seeds may be crossed with one that has *wrinkled* (sugary) and *yellow* seeds. Here the characters of the seeds belong to the embryo, hence the seeds resulting from the pollination show the results of the hybridization and in this case they are *round* and *yellow*, and so the qualities *wrinkled* and *green* are recessive. When plants from these seeds are grown to maturity and self-pollinated, four kinds of seeds are produced: *round yellow; round-green; wrinkled yellow;* and *wrinkled green.*

Garden peas have two sets of seven chromosomes each, or seven from each parent, but the contrasted pair of characters *round* and *wrinkled* are carried in one pair and the characters *green* and *yellow* are carried in another pair, and so in tracing the determiners for these two pairs of characters one may simply consider the behavior of two pairs of chromosomes.

The parent with *round-green* seeds produces spores and germ cells that are all *Rg*. The other parent has germ cells that are *wY* The union of these in cross-fertilization produces embryos in seeds that have the composition *Rw Yg* and are round and yellow in appearance. When these hybrids grow to maturity they produce spores and sex cells of four kinds: *RY*, *Rg*, *wY*, and *wg* and in the following self-fertilizations nine different *kinds* of recombinations are possible. If one estimates these on the basis of equal chance fusions between four of each type of egg with each type

of sperm the results may be shown in a checkerboard diagram, thus:

Eggs	RY	RY	RY	RY
Sperms	RY	Rg	wY	wg
Eggs	Rg	Rg	Rg	Rg
Sperms	RY	Rg	wY	wg
Eggs	wY	wY	wY	wY
Sperms	RY	Rg	wY	wg
Eggs	wg	wg	wg	wg
Sperms	RY	Rg	wY	wg

But the different kinds of offspring in this F_2 population fall into four classes in respect to *appearance* and nine groups in respect to the *combination* of germ plasm units:—

(I) $1\binom{RY}{RY}$; $2\binom{RY}{Rg}$; $2\binom{RY}{wY}$; $2\binom{RY}{wg}$ and $2\binom{Rg}{wY}$, or nine hybrid embryos that are round and yellow.

(II) $1\binom{Rg}{Rg}$; $2\binom{Rg}{wg}$; or three that are round and green.

(III) $1\binom{wY}{wY}$; $2\binom{wY}{wg}$; or three that are wrinkled and yellow.

(IV) $1\binom{wg}{wg}$, or one that is wrinkled and green.

Careful experimental studies of this case with records of pedigreed cultures show that the actual results conform to this explanation within the limits of probable error.

Of these F_2 embryos only the first named in each group will breed true to both characters, the others all have a difference in at least one pair of contrasted determiners. Thus, if one wishes to obtain from these hybrids a race of garden peas that produces only *round yellow* seeds, there is one out of nine embryos in Class I that will give this result. This could be determined by self pollinating a sufficient number of the F_2 plants grown from *round yellow* seeds and then selecting seeds from those that produce only *round yellow* seeds. In this way a new race could be obtained. It is of interest to note that all four types of seeds are to be found in the pods of the F_1 hybrids, thus completely upsetting the old adage, "Alike as two peas in a pod." In these results no new characters appear, but characters of different parents are obtained in one plant, giving two types (1) *round yellow* seeds and (2) *wrinkled green* seeds, which are combinations not seen in the parents.

It is of interest to note that the different genetic constitutions in various sister hybrids and the mechanics of the heredity involved could only be discovered experimentally by making controlled cross-pollinations of parents, followed by controlled self-pollinations of F_1 hybrids and of numerous F_2 hybrids, and then growing the offspring in pedigreed culture. This is what Mendel did better than any of his predecessors, as early as 1865. But it was not until about 1890 when microscopic studies had shown the reduction of units of germ plasm in the formation of spores and their doubling in fertilization that the significance of such experimental data was realized. The older methods of breeding by mass selection on the basis of the appearance of plants then quickly gave way to pedigreed selection based on the behavior of characters in a series of known parents and in their offspring as tested by controlled self- and cross-pollinations.

An increase in the number of differences in characters that are represented in various pairs of chromosomes of parents gives greater diversity among hybrid offspring. When there are six contrasted differences determined by units in six different pairs of chromosomes with free assortment, a total of 64 kinds of germ cells are possible and the number of different *kinds* of recombinations is 729; and unless the progeny are grown in large numbers no two of them will be alike in all respects.

III. New Quality in First New Generation

The class in which a single new characteristic appears in the F_1 hybrid and is continued in later generations may be illustrated by the hybrids of certain red-flowered and white-flowered races of the four-o'clock (*Mirabilis*) which have pink flowers. The two elements of germ plasm, one of which makes red and the other of which makes white, interact in the cells of the hybrid to produce pink. The F_1 hybrids have the composition *Rw;* they form sex cells with *R* and with *w;* the fertilization recombines these into 1 *RR* which has dark red flowers, 2 *Rw* which are pink-flowered, and 1 *ww* which is white-flowered. In this case no new type of flower appears after the F_1 generation, and the new type can be had only in hybrids, which do not breed true to the pink flower-color.

Several points of practical interest may be noted in this type of result. The seeds of pink-flowered plants (*Rw*) will produce half red and half pink if they are pollinated from red-flowered plants; if they are self-pollinated or crossed among each other there will be on the average ¼ red, ½ pink, and ¼ white; if pollinated with white-flowered plants they give ½ pink and ½ white. To keep the pink flowered plants in existence the gardener needs only to collect seed from such plants. In certain groups of hybrids, however, it has been found that all recombinations die except the one which gives the hybrid. In such cases the hybrid type appears to breed true when intra-pollinated, but when crossed with some other type from which all combinations survive there may be two types of offspring in the first generation.

IV. Second Generation Shows Gradations

Hybridity that gives many gradations in a character may be illustrated by the results obtained when a certain red-seeded wheat was crossed with a white-seeded wheat. The F_1 produced seeds that were light red in color. In the colors of the seeds of the various F_2 plants there were many gradations, ranging from red to white. Geneticists interpret this result in terms of multiple factors that have accumulative reactions. The red color of seeds in the one parent appears to be due to several units of germ plasm. The F_1 hybrids possess half of these and are light red. The recombinations of these factors in different numbers in the various

individuals in the F_2 result in different degrees of red in seeds according to the number of factors present. Many so-called quantitative characters are extremely complex, both in their expression and in their inheritance.

V. Hybrids That Have New Characteristics

The hybridizations which have greatest interest to plant breeders and greatest value to horticulture are those which bring new characteristics into existence. These may be illustrated by the following cases: –

By hybridizing certain varieties of white-flowered sweet peas, each of which breeds true to the white coloring, a hybrid with colored flowers is obtained and its progeny (the F_2) display a wide range of flower colors from rich dark-purple, through various shades of purple, red and pink, to white. This rather astonishing and unexpected array of gay colorings derived from parents which are white-flowered may be viewed as a type of reversion. The colors produced are not necessarily new or unknown for the entire group of sweet peas, for the original wild progenitor of the cultivated sweet peas had purple flowers. The flower color of the F_1 hybrids of the white-flowered parents seems to be due to a complementary interaction between two series of hereditary units, either of which alone does not produce color and which have become separated or modified in the development of the white-flowered races. When these factors are brought together by hybridization, assorted in the production of spores and germ cells, and recombined in subsequent fertilizations, many shades of flower colors appear. But even if many such results are merely reversions to types previously in existence, their reappearance may be in associations that are new—such as larger flowers and more prolific blooming. Reversions are hence of value in plant breeding.

But hybridization between distinct natural species of plants actually brings into existence many characteristics not hitherto known in these particular groups of plants and which can not be considered merely as reversions. Wild species of day-lilies with yellow, with orange, and with fulvous colorings in their flowers have all been utilized by repeated crossing as parents of hybrids. A great diversity of flower colors develops in the progeny. There

are many intermediate shades of color, there are many combinations of different elements of coloring, and there are various grades of intensification, especially of fulvous coloring. Plants are obtained having dark-red flowers, brilliant red colorings and with a much intensified eye-zone in the flowers. Also these hybridizations bring into existence a wide range of variations in size and form of flowers, in period of growth and season of flowering, in habits of growth as to height of flower stalks and foliage, and in character of foliage as to color and disposition of leaves. For some characters there is dominance (Class I); two or more dominant characters from different parents may be combined (Class II); certain pairs of characters show quantitative inheritance with numerous intergradations (Class III); for other characters there may be types of reversion (Class IV); and for many of the characters new qualities appear. As a result, no two seedling day-lilies of a complex hybrid generation are alike. Sometimes scarcely any two sisters of a population, of the size ordinarily grown, are exactly alike in respect to a single character, such as the color of flowers. From such a medley individual plants of special merit may be selected for propagation and garden culture or for use in selective breeding.

The results obtained in hybridizing various citrus fruits, a work begun over 30 years by Dr. H. J. Webber and Dr. Walter T. Swingle of the Bureau of Plant Industry, may be cited as noteworthy in the production of new types of fruits. A wild Japanese orange with small worthless fruits but hardy in the climate about New York was crossed with a type of the sweet orange in the hope of obtaining hardy citrus fruits of value. The hybrids obtained produced a remarkable new type of fruit so different from any type previously known that they were named "citranges." The fruits of the different hybrids vary greatly in size, shape, and color. They have an abundance of acid juice and are more useful as substitutes for the lemon than for the orange. Except for one hybrid, the rind of the fruit contains a disagreeably bitter oil somewhat troublesome in preparing the fruit for use. With continued selective hybridization and breeding hardy citranges with fruit more like the orange might be obtained.

Hybrids now known as "tangelos" were obtained between the tangerine and the pomelo or grape fruit. Their fruits are also of

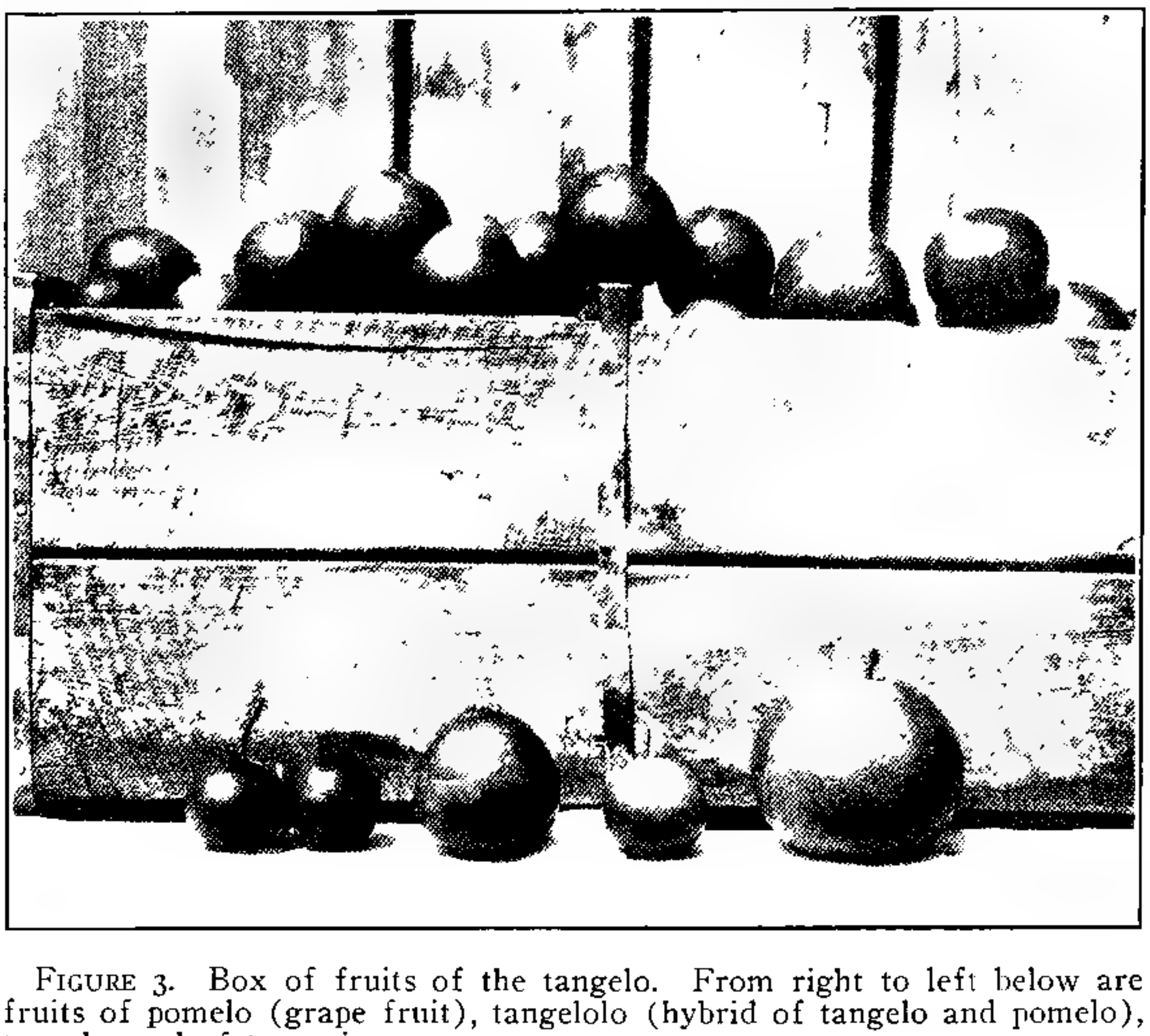

FIGURE 3. Box of fruits of the tangelo. From right to left below are fruits of pomelo (grape fruit), tangelolo (hybrid of tangelo and pomelo), tangelo, and of tangerine.

a new type with almost no characters precisely like those of either parent. The seedling which produces the best fruit is known as the Samson tangelo and it is now being grown to some extent in Florida.

By hybridizing the tender West Indian lime with the very hardy kumquat orange, hybrids known as "limequats" have been obtained, which are much more hardy than the lime and of which some have fruits somewhat similar in quality. Various other types of citrus fruits have been hybridized and in every case what may be called new fruits have appeared. Growers and the general public seem well satisfied with the types of citrus fruits now in culture, but extensive and repeated hybridization and selective breeding with these most promising citrus fruits would no doubt produce many new types of equal, or possibly of greater, value than those in cultivation of today.

For many years hybrids between distinct species and even between species of different genera have been known and it has

been recognized that in certain cases such hybrids may be more or less fertile and may breed true to quite a new type of plant. For about one hundred years it has been known that hybrids between the common garden radish (*Raphanus sativus*) and the cabbage (*Brassica oleraceae*) are possible. Usually these have been considered as sterile or as very feebly fruitful. Recently, however, a Russian botanist, G. D. Karpechenko, made careful studies of such hybrids and has succeeded in developing a fertile strain. A study of spore formation shows how this has been possible. In the F_1 hybrids the processes of sporogenesis are very erratic but in a few cells the reduction divisions are omitted and the 9 chromosomes from the radish parent and the 9 chromosomes from the cabbage parent are all carried over into spores and gametes. Then after fertilization between such gametes the F_2 plants possess in each cell a double number of each parental set. For such plants the processes of spore formation becomes much more regular and there is high fertility. Thus the progeny remain half cabbage and half radish and there has come into existence what may be regarded as a new species to which the generic name *Raphanobrassica* has been given. Plants of this new type have been hybridized with such other species as the turnip (*Brassica campestris*), the Swede turnip, Chinese cabbage (*B. pekinensis*) and thus normally developed vigorous plants obtained with the elements of these distinct species in their cells. A fertile triple hybrid involving three species of *Nicotiana* has recently been reported by Dontcho Kostoff (Am. Jour. Botany **18**: 112 113. 1931). It appears that a certain degree of wide crossing promotes the development of fertile constant hybrids such as are mentioned above. The studies of chromosome behavior in sporogenesis show how these arise. Such results stimulate interest in hybridization and indicate that it is indeed a potent agent in the production of new types of plants.

There are differences of opinion among plant breeders and geneticists as to whether hybridization can change the nature of the basic units of germ plasm or whether it merely brings the various units into new combinations. The matter is one of much interest and importance. Many hybridizations do not change the nature of the units which are involved; and changes in the units do occur which are apparently not directly related to hybridiza-

tion. But hybridization does bring new qualities and characteristics into existence in plants, producing new types of great value to man.

Hybrids are frequently more vigorous in vegetative growth than are the parents, and in many cases intervarietal hybridization also results in greatly increased yields of fruit and seeds. This condition, known as "hybrid vigor" or "heterosis," has long been observed and has led to the theory that cross-fertilization is beneficial and that inbreeding is injurious. But it is to be recognized that many plants are naturally self-fertilizing and show little or no benefits from crossing. Hybrid vigor plays an important rôle in cultivated plants. In many seed crops, such as corn, the maintenance of hybrid vigor requires constant and special attention to cross-breeding. In the plants that are propagated vegetatively, as are many ornamentals and such economic plants as the tuber crops, the maintenance of individual hybrids of unusual vigor is a simple matter.

Previous to about one hundred years ago hybridization was largely a matter of chance cross-pollination. Horticulturists assembled in their orchards different species and types of the various fruits and gardeners brought together collections of flowering plants, quite as they do today. This gives the opportunity for abundant chance cross-pollination by insects and wind, and so when the seeds of such plants were planted hybrids were frequently obtained.

In the centuries that have passed since men became gardeners, nature has thus assisted them in the quest for new plants in ways which were little understood. Also plants show what appear to be spontaneous variations or mutations that are readily observed, especially in cultivated plants, and selected as new types for culture or for use in hybridization. Under the gardener's protection many types which cannot survive in nature are kept living. By methods of vegetative propagation, some of which, such as grafting, are very artificial, the gardener is able to multiply many perennial plants of unusual character which do not breed true and which could probably never be secured again in another seedling. Thus such plants are maintained as clonal varieties through years of extensive propagation. By such means there have been developed and maintained the many clons of tulips, irises, dahlias,

chrysanthemums, peonies, asters, gladioli, lilacs, roses, rhododendrons, etc., which grace the gardens of today. By such means these groups will in the future be further improved. No doubt plants that are now wild will be utilized in the development of still newer kinds of plants of value in garden and orchard culture.

The art of breeding has greatly benefited from the knowledge regarding the processes of reproduction and heredity as this has developed during the past forty years. The science of genetics aims to discover by adequate methods of experimentation the laws of heredity in reproduction. It aims to determine the behavior and the nature of the units of heredity and to learn how these units change or "mutate," how they assume new properties, and how they originate. At the same time microscopic studies reveal much valuable knowledge regarding the actual behavior of the units of germ plasm.

The plant breeder now realizes that the qualities of a plant are primarily the results of activities of units of living material within its cells, that for at least many of the more specialized characters there are two pairs or two sets of determiners organized in the two series of chromosomes which are brought into the cells of a plant through fertilization, and that these are repeatedly reassorted in the formation of spores and sex-cells. Some of the highly specialized tasks in the development of characters are performed by a single unit, or a pair of similar units working together. Certain effects are produced by the combined activities of a pair of dissimilar units. For the development of many characteristics, numerous units interact with direct quantitative results, or with modifying results both quantitative and qualitative, giving modifications, reversions, or new qualities. In the development of many characteristics the coöperation of numerous different kinds of germ plasm is involved directly or indirectly and the analysis in terms of genetics and plant breeding becomes more difficult.

Many irregularities from the usual procedure are found in the reproduction of plants and especially of those groups in which hybridization has occurred. These irregularities develop especially during the processes of reduction in spore formation, and during the organization of the recombinations in fertilization, and they are reflected in fertility and in the character of the next generation of plants. Unbalanced numbers in the sets of chromo-

somes result in many irregularities during segregation, giving selective death to certain assortments or even complete abortion of all spores. Exchange of parts of pairs of chromosomes may occur. An entire chromosome or a complete set may be lost or duplicated. Many so-called mutations are the results of such irregularities. Several chromosomes of a series may be linked together. Various types of selective fertilization may occur which restrict parentage. Actual changes occur in the nature of the units of germ plasm evidently both by spontaneous changes and as a result of hybridization. The geneticist and the plant breeder never know in advance just what particular behavior will occur or what result will be attained when breeding is begun with a new group of plants.

It should be emphasized that the plant breeder or the geneticist does not in a strict sense *produce* hybrids. He can direct the course of the processes of fertilization by controlling the pollinations and to this extent determine parentage. He can, to a certain degree, force or induce cross-breeding and obtain hybrids which may never occur in nature. And he can use judgment in choosing parents, skill in manipulating the pollinations, and intelligence in selecting the offspring in studies of heredity or in selective breeding which aims to produce plants of value to mankind.

A. B. Stout.

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BOTANICAL CROSSROADS, HISTORIC AND PREHISTORIC

From boreal regions almost to the tropics, one can now drive by automobile over a direct route. Since the completion of a new highway to the Hudson Bay region in Canada and others leading to Cape Sable on the Florida peninsula and to Key West on the Reef, with the intervening roads already built, a feat that a few years back would have been called fantastic, is now made possible.

And while this route itself is distinctly modern, it crosses on its way many historic, even prehistoric, trails over land and water, used by the aboriginal nations,—the Algonquian, Iroquoian, Sionan, Uchean, Muschogean, Timuguanan, and Arawaken. The

lower part of its course traverses the territory of an unknown aboriginal or Indian nation. In these last few hundred miles, besides historic Seminole outposts, there have been revealed the village-sites, kitchen-middens, and burial grounds of this earlier tribe. But as they have been revealed, they have been obliterated with the building of the road, and no one, apparently, has recorded the traces of the life of these people, extinct now for several hundred years.

The only documentary evidence we have of their existence is contained in the meager records made by the Europeans they captured and held prisoners for a period, mainly in the sixteenth century. But the plant life of the region tells its own story of the civilization of this now lost tribe.

The aborigines built mounds, made trails, and dug canals! The first have weathered the centuries well enough to be quite evident today; the last have been mostly filled in with sand and silt, but their courses may still be traced.

The modern Seminoles and the ancient aborigines had trails running from the Everglades and Whitewater Bay to Florida Bay and the other waters along the eastern Florida coast. If they wanted to take their dug-out canoes with them either way they had to drag them over the land.

The aborigines of old exhibited many of the same characteristics as the white man today. The propensity of both for living in impossible places is nothing short of pathetic. This peculiarity, former and present, is much in evidence in peninsular Florida. In the mangrove swamps lying between a chain of lakes, Coot Bay, Mad Lake, and Bear Lake and the Bay of Florida there are several Indian mounds. The selection of this region for a settlement seems as inexplicable as some of the sites selected by the white man today. To any one who has traveled through this region the lack of an outlet is evident. So the red man dug a canal from Mad Lake to the Bay of Florida. This passed near the mounds and gave this settlement easy and safe access to the vast Whitewater Bay region to the north and to the Bay of Florida to the south, eliminating a long and perhaps rough water journey around the capes.

This ancient canal has filled in with marl during the centuries since it was in use. However, the filled-in materials, with per

haps a different water content from that of the bordering lands, support a different plant association and through this difference in vegetation the course of the old canal can be traced from the lake to the bay. The difference in the mud in the canal is indicated in still another way. Where the embankment of the new Cape Sable highway crosses the old canal the roadbed continues to settle into the former channel and soil from the channel is quite different from that from its banks. Furthermore, the course of the canal can be traced by oyster shells which line its banks in the form of small kitchen-middens, many of which have gradually sunken into the mud.

The modern trails cross this ancient one in several places where these characteristics are evident. Judging by the local evidence as compared with our standards of living, the old red man there surely led a sorry existence.

The mounds mentioned above are situated in the dense jungle, but they may be located by the royal-palms growing on them. They are doubtless the descendants of those the aborigines perhaps introduced for furnishing part of their food supply. This suggests the old question: was the royal-palm introduced into southern Florida from Cuba through natural channels or did the Caribs introduce it? In either case, the royal-palm added to the vegetable diet furnished by the other palms of the region and by the various berry-bearing shrubs and trees, the roots, etc. Furthermore, the old water highway dug by these enterprising aborigines enabled them to vary their meat diet with fish, shell-fish, the manatee, the crocodile, and the alligator from the bay and the lakes, and gave a wider range of country for drawing on the various mammals and birds.

JOHN K. SMALL.

HERBACEOUS PERENNIALS[1]

The growing of herbaceous perennials is one of the most satisfying branches of outdoor gardening. This phase of horticulture gives large dividends in beauty, pleasure, and satisfaction, with

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, December 6, 1930, by the Horticulturist of the Brooklyn Botanic Garden.

comparatively little expenditure of time, money, and effort. And yet, in the development of the perennial border, ample opportunity is afforded for the exercise of cultural skill and brainwork of the highest order, if the garden is to be arranged with regard to color, height, and time of blooming, and then properly maintained.

A perennial border is a permanent thing and, to get best results, soil preparation must be deep and thorough, with liberality in the supply of plant food. Planting may be carried out in the spring or fall but it is desirable to perform the work of soil preparation several weeks in advance of actual planting.

Although a perennial border may be as little as two feet wide, best results are obtained when the width is considerably greater than this—say, eight to ten feet. This width affords greater opportunity for artistic grouping and harmonious relation of the component plants.

Although, by making use of spring- and fall-blooming bulbs, the blooming period of the border may be made to extend from March to November, it is not always wise to attempt this, for it frequently happens that the owner is away throughout a large part of the growing season and it is a waste of space to grow plants that blossom only then. In all cases, a plan should be made before actual planting starts. The lecturer demonstrated on the black board the methods followed in making a planting plan.

Routine work consists of surface cultivation, watering when necessary, thinning, staking and tying, fertilizing special subjects with liquid manure or concentrated fertilizers, and periodical division and replanting of some plants, such as Chrysanthemum, Hardy Aster, Phlox, Veronica, and Peony, varying from every year to every ten years, according to subject.

The most desirable plants for the perennial border were discussed with special reference to their cultural requirements. These included Goldentuft, Hollyhock, Anemone, Columbine, Aster, Bellflower, Chrysanthemum, Delphinium, Dianthus, Foxglove, Gaillardia, Gypsophila, Sunflower, Day-lily, Iris, Lily, Peony, Phlox, Primula, Sedum, Globeflower, and others.

Preceding the lecture, demonstrations were given of methods of propagation by seeds, cuttings, and division; soil preparation; planting, and supports for plants.

MONTAGUE FREE.

OBSERVATIONS ON ROOT GROWTH FROM CUTTINGS[1]

Factors involving root growth from cuttings are as follows:

Temperature: Roots will grow from cuttings over a wide range of temperatures but there is usually an optimum temperature, which varies with the species. In general, the optimum falls somewhere between 60° and 75°. Roots will grow with temperatures much lower than the optimum but require more time for good growth. For example, some cuttings will root in three months' time at 50° F., whereas they will root in three weeks if placed at 70° F.

Water factors: At the time the cutting is made it has usually an optimum water-content. As soon as it is separated from the mother plant it has the problem of absorbing moisture from a new source. The place of absorption is at the basal cut surface. The chance for water absorption in such a small area is very limited, and the problem is to maintain an atmosphere above the cuttings that will prevent evaporation or permit of maintaining a balance between the water exits of the cutting and the water intake from the medium. As soon as the cutting dries the growth is decreased or stopped. The water balance is best maintained by placing the cutting deep in the medium or maintaining a high relative humidity until roots start.

Oxygen: This is seldom a limiting factor if cuttings are placed in the rooting medium. The soil is porous enough to permit of the low supply of oxygen that is needed by cuttings. When grown in water, however, the fact that roots grow near the surface better than at the base of the cutting in deep water indicates that the oxygen supply is too low. Also, when the water is aërated, root growth takes place at the base of the cutting, therefore showing the necessity of a good oxygen supply.

Media: Most cuttings will grow in a wide variety of media. If the cuttings are not sensitive to acidity, the mixture of peat moss and sand usually furnishes a satisfactory medium. Peat moss is more or less sterile and holds moisture much better than pure sand.

[1] Abstract of a lecture for class instruction given at The New York Botanical Garden on January 10, 1931.

Season of the year and light: Many cuttings grow best if made in June or July on greenwood material, and then planted so that they can have the light. Light is necessary on greenwood cuttings. It is not necessary for hardwood cuttings to initiate roots, but, if they are to be continued for some time, light is essential. Some cuttings which will not grow in the summertime may be grown from hardwood cuttings during the winter and vice versa.

Age of tissue. Species vary in the requirements. Some root best when old tissue is attached to the basal part of the cutting and others root best when all of the old tissue is eliminated. The requirements have to be worked out for individual species and it is not safe to generalize.

Inherent qualities: There is something inherent in varieties which cannot be overcome by practice. If a cutting lacks the capacity to form roots from stems, then it is impossible to propagate plants from cuttings. There are a few species of this sort.

Holly cuttings were made and planted in sand to demonstrate the best method of planting cuttings with leaves. Hardwood material was supplied and the method of making cuttings was demonstrated. The class had some practice in making various kinds of cuttings.

P. W. ZIMMERMAN.

A NEW BOOK ON ALPINES BY MRS. McCULLY[1]

Added to the list of books on rock and water gardens this spring is an enticing volume from the pen—and experience—of Anderson McCully and the press of Macmillan, entitled "American Alpines in the Garden."

Enticing it is, first because, after four brief but thorough chapters on the building of a rock or water garden, Mrs. McCully leads her readers on foot over the high peaks of the western mountains -from Mount Rainier and its vicinity through Glacier Park, from the Siskiyous to the High Sierras, among the Rockies of the extreme east and the Coast Range of the extreme west, and into the

[1] McCully, Anderson. American Alpines in the Garden. i–xii + 1–251. The Macmillan Company, New York, Mr 1931. [Illust.]. Price, $2 50.

mountains of the desert and the southern border of the United States. And all the way there are flowers -magnificent flowers, delicate flowers, some remote and rare and some abundant.

She further proves her knowledge of them by describing the habits, habitats, and requirements of some 600 species which, she says, can, with proper caution, be transferred to one's garden. The majority are best brought in by seed, she says, though roots kept well moistened will sometimes adjust themselves to new surroundings, and cuttings with a bit of root attached will often prove adaptable.

Mrs. McCully tells in assuring detail—alluring every reader, it would seem, to build an alpine garden at once—how one can imitate the sun-baked rocks of mountain heights, the flat moraine composed of glacial débris, the rough cliff watered by a gentle seepage, the shady hollow which gives other plants their natural surroundings, and the mountain pool and stream with their aquatic plants and near-aquatics, even when one has no flowing water on the grounds.

Every plant described in the book, according to her publishers, Mrs. McCully has raised herself. At the end she classifies all the alpines according to their habits and requirements.

CAROL H. WOODWARD.

NOTES, NEWS, AND COMMENT

In addition to the arrangements with Sun Yatsen University and the University of Nanking, noted in the February number of the JOURNAL, Dr. E. D. Merrill, Director-in-Chief, has made an agreement with Lingnan University of Canton, for coöperative work in the botanical exploration of southern China.

Dr. E. D. Merrill, Director-in-Chief, has been appointed a member of a committee of The National Parks Association "to study the functions and uses of National Parks as a guide in determining how to maintain the proper balance between protection of primitive features in the parks and development of these areas for the purpose of making them accessible to the people."

The mycological department of The New York Botanical Garden has recently mounted and filed in book form nearly 10,000

specimens of fungous exsiccati. Most of these are duplicates of specimens already distributed through the collection. However, as it is often very difficult to locate these specimens by number, it is very convenient to have duplicate sets filed in serial order. It is hoped that eventually all published sets of exsiccati may be so arranged.

Dr. B. O. Dodge has just turned over to the Mycological Department one hundred specimens of fungi "Herbarium Mycologicum Romanicum," issued by Professor Dr. Tr. Săvulescus of Roumania. These specimens are unusually well put up, with descriptive labels, and they are a valuable addition to the collection of exsiccati.

The following visiting botanists have enrolled in the library during the winter: Dr. I. M. Johnston, Cambridge, Mass.; Prof. John E. Jack, Jamaica Plain, Mass.; Prof. M. A Chrysler, New Brunswick, N. J.; Mrs. Allan Marquand, Princeton, N. J.; Dr Edgar I. Wherry, University of Pennsylvania, Philadelphia, Pa.; Prof. L. O. Overholts, Pennsylvania State College, Pennsylvania; Miss Phoebe M. Knappen and Mr. E. L. Killip, Washington, D. C.; Mr. Myron A. Rice, Clemson College, S. C.; Prof. Shigeo Yamanouchi, University of Chicago; Dr. Caroline Rumbold, Madison, Wis.; Prof. H. M. Hall, Carnegie Institution, Stanford University, Cal.; Mr G. A. Ledingham, University of Toronto, Can.; Prof. A. H. Reginald Buller, University of Manitoba, Winnipeg, Can.; Dr. Mel T. Cook, Rio Piedras, P. R., and Dr. N. I. Vavilov, Leningrad, U. S. S. R.

Mr. John A. Stevenson, mycologist of the Bureau of Plant Industry, Washington, D. C., spent several days at the Garden in March, looking over fungi belonging to the family Perisporiaceae. Mr. Stevenson has spent several years in Porto Rico and has become especially interested in this group of fungi, most of which are tropical.

A trust fund for botanical research has been established at the University of Minnesota as the result of a request made by the late Dr. J. Arthur Harris a year ago on his death-bed. He asked that nothing be spent on flowers for his funeral, but that the

money be put into a trust fund for research in botany. The fund, contributed by university staff members and others, now totals $1,066.21. Dr. Harris was head of the Botany Department at Minnesota and was also connected with the Agricultural Experiment Station of the university. He was an authority on biometrics, and one of the four authors of "The Measurement of Man," a study in that field adopted by the Scientific Book Club last summer.

The Rev. Dr. Alpheus Baker Hervey, author of popular books on botany, such as "Sea Mosses," "Beautiful Wild Flowers of America," "Flowers of Field and Forest," and "Wayside Flowers and Ferns," and translator of of Behrens' Guide to the Microscope in Botany and of Strassburger's "Das botanische Practicum," died at Baldwin, Long Island, on March 10, a few weeks before the completion of his 92nd year. From 1888 to 1894, Dr. Hervey was President of St. Lawrence University at Canton, N. Y. He was associated with the late F. S. Collins in the publication of a work of 195 pages and 6 plates on "The Algae of Bermuda," which appeared in 1917. Much of his time in later years was spent in Bermuda, where he continued to collect algae up to the last five or six years. Dr. Hervey was a frequent visitor to The New York Botanical Garden and many of his later collections of algae were sent here for determination.

Meteorology for March. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 50° F. on the 2nd and 6th; 53° on the 14th; 56° on the 18th; and *61° on the 27th.* The minimum temperatures recorded were: *24° on the 3rd;* 26° on the 14th; 30° on the 18th; and 39° on the 24th. The total precipitation for the month was 4.18 inches. Snow fell on the 4th which measured 1½ inches and which has been figured as .15 inches of rainfall in the total amount of precipitation. Traces of snow also fell on the 10th and the 19th.

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Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

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Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Vol. VII. Includes New Myxophyceae from Porto Rico, by N. L. Gardner; The Flower Behavior of Avocados, by A. B. Stout; Descriptions of New Genera and Species of Plants Collected on the Mulford Biological Exploration of the Amazon Valley, 1921–1922, by H. H. Rusby; and The Flora of the Saint Eugene Silts, Kootenay Valley, British Columbia, by Arthur Hollick. viii + 464 pp., with 47 plates, 10 charts, and 11 text-figures. 1927.

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Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

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A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

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Scientific research in laboratories and in the field into the diversified problems of plant life.

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Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
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Fellow for Life	single contribution	1,000
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Conditional bequests may be made with income payable to donor or any designated beneficiary during his or her lifetime.

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H. A. GLEASON
BEGONIAS AS HOUSE PLANTS
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THE WATER-LILIES OF THE UNITED STATES
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NOTES, NEWS, AND COMMENT
ACCESSIONS

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A DESTRUCTIVE RED-CEDAR RUST DISEASE[1]

Two years ago Dr. G. P. Clinton, preparing a program for the Fifth National Shade Tree Conference, asked the writer to discuss methods of controlling the apple rusts without removing the cedar host. This was, in effect, a request to defend the red cedar, *Juniperus virginiana,* against the charge of being a public nuisance, brought against it by apple-growers of this country.

It is claimed that the apple is subject to attack by species of rusts belonging to the genus *Gymnosporangium*, which cause losses up to 50 per cent or more in cases of certain varieties. The red cedar is well known to be the alternate host for these criminal fungi. Furthermore, it has been found that the ordinary spray schedules followed to control other fungi and insect pests of apples are not effective in preventing great losses due to the two cedar-apple rusts. Of the two alternate hosts the apple is the only one, it is claimed, that suffers. Only in rare cases are the cedars so loaded with the galls as to suffer much damage. The galls characteristic of these two species develop only from leaf tissue and the tree rids itself of the individual infections naturally after two or three years, because the fungus mycelium does not become perennial by penetrating down into the branches.

In recent years it has been proved that a third species of rust, *Gymnosporangium germinale* (*G. clavipes*), severely attacks the fruit of several varieties of apple, rendering it unsalable. This species is perennial in the limbs and trunk of the cedar. The fungus develops largely in the outer cortex just beneath the corky bark, however, so that it does not seriously affect the cedar host.

[1] Studies in the genus Gymnosporangium—V.

FIGURE 1. Explanation on opposite page.

Thus on three counts the red cedar is condemned, and the only remedy, the apple-growers say, is to destroy all red cedars.

Some states, notably New York and Virginia among others, have passed laws designed to compel property owners in certain sections to cut down all red cedars on their premises which are within infecting distance from commercial orchards. As the apple-growers are usually well organized, these laws are more or less effective and have been upheld in the higher courts. Against the claim that the red cedar is of no special account as an ornamental may be cited the remark of a gentleman who had just brought an apple orchard in Virginia into bearing at considerable expense: "If it comes to a question of the apple tree against the cedar," he said, "we shall have to cut down the apples." The stately old cedars had long stood guard about his colonial dwelling and they were not to be sacrificed.

This note is not particularly a defense of the red cedar as an ornamental or as a welcome break in a dreary Long Island landscape, or as cooling shade for domestic animals in old New England pastures. Rather it is to direct attention to a rust disease which is slowly but surely contributing to the mortality of red cedars in the East.

Few places in this part of the country can boast of such beautiful old trees of various species as can be seen in Arlington National Cemetery, Virginia. On the east slope of the ridge on which stands Lee Mansion, overlooking the city of Washington, are, naturally, a number of red cedars. Ten years ago there were to be found any number of examples of the destructive effects of what appears to be the effuse type of infection by *Gymnosporangium Nidus-avis*. Limbs up to six inches in diameter are frequently roughly scarred for several feet, and every year such limbs as have died are cut out. There is scarcely a tree still standing that does not show several serious trunk and limb infections.

The natural alternate hosts for *G. Nidus-avis* are species of *Amelanchier*, but, as has been confirmed by others since then, the writer has proved conclusively that the apple can also be infected.

FIGURE 1. A. Portion of trunk of a young red cedar three years after inoculation with *Gymnosporangium Nidus-avis*. B. The same as A after having been wet to cause the rust sori to swell. Natural size.

FIGURE 2 Explanation on opposite page.

It is interesting to see, however, in such places as The New York Botanical Garden and other parks, that red cedars planted in recent years show no sign of infection by this fungus, although one can infect *Amelanchier* readily with the rust from the old cedars.

While making a study of the cedar rusts some fifteen years back, it was observed how destructive to the cedar some of the species could be. It is a pleasure to acknowledge here again the valuable assistance in that work, rendered by Professor R. A. Harper, in the form of enthusiasm and material things.

To quote from a paper written in 1918:[2] "The red cedars on Long Island and in the vicinity of New York are badly infected with a *Gymnosporangium* which, if the infections are due to a single species, is certainly multiform in its manifestations. *Amelanchier* and *Malus* have been infected with spores taken from each of the following forms, although the inoculations were not made in each case with a single sorus: (1) Sori in the axils of densely crowded acerose leaves; (2) sori caulicolous, large branches forming coarse witches'-brooms; (3) trunk infections, sori appearing in deep fissures in the thickened bark. There is perhaps another form recognized by the presence of long parallel cork ridges, about one centimeter in width, that mark the location of sori of former years." Of one tree it was said: "The trunk of this tree is heavily infected for a distance of several feet and has developed a large spindle-shaped swelling three feet long about ten feet above the ground."

The rate with which trunk infections spread is shown in FIGURE 1. As compared with pear blight, the spread here might not seem very rapid. It is because of this rather slow rate that the ultimate damage done by this rust has heretofore not been realized. The small potted cedar was inoculated by spraying it with a suspension of aeciospores taken from apple leaves previously infected with teliospore material from a witches'-broom which involved large branches. Infection first showed two years later

[2] Dodge, B. O. Studies in the genus Gymnosporangium—II. Report on cultures made in 1915 and 1916. Bull. Torrey Club **45**: 287–300. 1918.

FIGURE 2. Red cedar showing swelling of trunk and excessive growth of strips of bark in the region infected with the rust fungus *Gymnosporangium Nidus-avis*, completely encircling the tree. The black strip on the side of the other cedar shows a more localized trunk infection by another species of rust.

FIGURE 3 Explanation on opposite page.

in the form of two stem sori at a point about the middle of the spindle-shaped portion of the small trunk shown in this figure. The infection spread at least six inches vertically in both directions and completely around the stem during the first three years. Some of the sori were at least two inches long. At the left in the picture is shown the infected section of the trunk in a dry condition. At the right the same part in a slightly different position is shown as it appeared two hours later, after it had been wet to cause the sori to swell. Just how long such a tree infected in nature in this manner would have lived is uncertain.

The picture of a cedar by the roadside in Long Island shown in FIGURE 2 is of a similar type of infection which must have been of many years' standing. In such cases there are strips of cambium and inner bark which run up and down, connecting in a zigzag fashion, so that there is still provision for the flow of foods. The corky strips of bark which develop over the wounded portions between the sori are characteristic of this type of infection. A piece of limb having the same kind of infection is shown in FIGURE 3, A. The irregular orientation of the swollen sori is plainly indicated in this picture.

The most destructive type of infection occurs when the fungus travels straight up and down, causing the development of long, parallel, closely-set ridges, as shown in FIGURE 3, B, C. The lower figure shows a piece of limb that had died because the fungus had completely circled the limb for two or three feet. In the center figure the region covered by the lower four or five ridges is dead. The fungus is moving slowly around the limb, as evidenced by the two rows of swollen sori beyond which (above in the picture) the fungus has not as yet penetrated. Small boys are sometimes said to relish the cedar-apples stimulated to form by *Gymnosporangium Juniperi-virginiae*. This may well be believed, because if one had cut out the ridge-like galls shown in this figure in the spring of the year when they were alive, he would have found them composed of rather firm cortical tissue

FIGURE 3. A. Telial sori of *Gymnosporangium Nidus avis* on a limb of red cedar. Sori irregularly oriented. B. Below are seen four or five ridges denoting the location of sori of previous years. Above are two or three rows of swollen sori showing that this part of the limb is still alive. C. Remains of ridge-like galls on a limb killed by a long-standing infection of the effuse type. Natural size.

filled with rich foodstuffs of a pleasant nutty flavor. Instead of forming " cedar-apple " galls, this species causes truncate ridge-like galls well supplied with food for the development of the sori to be formed. After the teliospores have matured, the gall tissue becomes brown, more or less suberized, and transformed into a ridge which seems to serve as a sort of cork callus.

Recent observations on the condition of trees now as compared with what they showed fifteen years ago bear out the predictions made at that time. Many of the old familiar trees have disappeared, some of them no doubt strangled by poison ivy; others, perhaps, as some have thought, were unable to withstand continued infestation by " red spiders." It is clear that when large numbers of branches of the tree are infected with *G. Nidus-avis* so that witches'-brooms are formed all over the tree, considerable damage is bound to follow.

Nevertheless, it is the deep-seated trunk infections which destroy the cambium and inner bark that are the most serious, and when this parasite in its effuse form becomes firmly established on the large limbs and main trunk, the tree is, to say the least, seriously handicapped. The great damage done the southern white cedar, *Chamaecyparis thyoides,* by two other species of *Gymnosporangium* will be described in a later note.

B. O. Dodge.

SCIENTIFIC EXPEDITION TO VENEZUELA

The Pacaraima-Venezuela Expedition has recently published a handsomely printed and illustrated prospectus, setting forth the plans for the proposed expedition, which is expected to leave New York late in the summer for an extended and comprehensive survey of the unexplored mountain range lying on the border between Brazil and Venezuela. This expedition will be of special interest to members and friends of The New York Botanical Garden, since the Garden is an active participant.

This is the first expedition ever undertaken as a coöperative project from three leading metropolitan institutions, the other two being the American Museum of Natural History and the American Geographical Society. The difficulty and expense involved in reaching this remote region make a coöperative effort essential,

while the fact that it is an almost completely unexplored region gives promise of results of the highest importance in several lines of scientific investigation, extending beyond the fields of any one of the three organizations.

In order to facilitate the conduct of the expedition, an independent company has been incorporated under the laws of the State of New York governing membership corporations, with H. E. Anthony, of the American Museum, as president, H. A. Gleason, of the Garden, vice-president, and Raye R. Platt, of the Geographical Society, secretary. The other members of the corporation are the directors of the three coöperating institutions. The charter gives the expedition all necessary powers to carry on the exploration, distribute the material collected, and publish the scientific results.

The Pacaraima Mountains cover an area about as large as the State of Maine, extending some 400 miles in an east-west direction. Only the mountains at the eastern and western ends of the range have been mapped by geographers or studied by biologists. This exploration has centered until recently around the famous Mt. Roraima, rising to a height of about 8,600 feet at the point where Venezuela, Brazil, and British Guiana meet. Its lower slopes have been explored, mostly at long intervals, by various scientists during the last 90 years, but are still imperfectly known because of the relatively inaccessible location, entailing much expense and difficulty in transporting supplies. The mountain has been ascended by several persons and the flora of its small flat summit is fairly well known.

Mt. Duida, at the western end of the range, rises to a height of more than 7,500 feet above the Orinoco lowlands in southern Venezuela. Although known to geographers and biologists for more than a century, it was never ascended until 1929, when Mr. G. H. H. Tate spent several weeks on its broad summit and returned with a remarkable collection of plants and animals. His botanical collections were presented to the Garden by the American Museum and represent the sole basis of our limited knowledge of its flora.

Between these two extremes lies the vast unexplored range of the Pacaraimas, as yet unknown biologically and only partially and probably inaccurately mapped. Robert Schomburgk crossed

the range in four places nearly a century ago and located a few points by astronomical observations. Koch-Grünberg made some studies of the Indians in 1904. More recently Desmond Holdredge, of the Brooklyn Institute, has penetrated the range at a different place. Maps generally show various rivers rising in these mountains and flowing south toward the Amazon or north into the Orinoco. The existence of such rivers is certain, but their exact location, their connection with lowland rivers, or the height of the mountains is unknown and the information given by existing maps is largely hypothetical.

The plans of the expedition include the use of aëroplanes to reach the Pacaraimas. An airport has already been established at Ciudad Bolivar, on the lower Orinoco, and from there the upper reaches of the Caroni River can be reached in a three-hour flight. This method of transport will not only save some two or three months of laborious travel on foot, but will save the expense of a pack-train of probably three hundred Indians. Finding so many Indians is itself difficult, and organizing and feeding them adds still more trouble to the conduct of an expedition.

Three aëroplanes will be used by the party, two of them capable of carrying each a thousand pounds of pay-load, and the third a light plane for scouting. Several trips will be necessary to get the whole party, with its several tons of supplies and equipment, to the base-camp. After that, the planes will be used in aërial mapping of the region, in transporting its members to various temporary camps, in returning collections to the sea-coast for shipment to New York, and for bringing in mail and fresh supplies.

The leader of the expedition is H. E. Anthony, of the American Museum, a man of wide experience in field work, and he will be assisted by G. H. H. Tate, who has a personal acquaintance with some of the Indians of the region, made during his trip to Mt. Roraima a few years ago. Geographical work will be cared for by C. B. Hitchcock, who has already mapped Mt. Duida. The aërial geographical survey is assigned to A. C. McKinley, who was aërial photographer on the recent Byrd expedition to Antarctica. G. C. Graves, 2nd, and W. B. Millar, Jr., are the geologists; C. H. Curran, entomologist; A G. Hassler, herpetologist; and G. A. Thorne, chief pilot, late of the Byrd Expedition; two or three other members will be chosen later.

The botanical interests of the party will be cared for by two men, A. C. Smith, of the Garden staff, and N. Y. Sandwith, of the Royal Botanic Gardens at Kew, England. Mr. Smith has already made two extensive trips in South America, the first through Colombia in 1926–27 and the second across Peru and down the Amazon in 1929. Mr. Sandwith is noted as a student of the flora of northern South America and was a member of the Oxford University expedition to British Guiana in 1929. Both of these men are unusually well qualified for their positions on such an expedition. If sufficient funds are available, an expert collector of live plants will also be attached to the party.

Some of the remarkable floristic features of this region became known when the Schomburgk brothers first collected there nearly a century ago, although their botanical activities reached only the extreme eastern end of the range, around Mt. Roraima. Since then Roraima has been known as a center for a peculiar flora, characterized by an extraordinary number of local endemic species and by an unusually large proportion of plants with large and beautiful flowers. Although several other collectors have since then penetrated to Roraima or actually reached its summit, it is probable that not more than half of its plant inhabitants are as yet known. At the other extremity of the range, Mt. Duida has been ascended but once, and the limited collections made by Mr. Tate, a zoölogist, in his spare time, contained no less than 166 species of flowering plants and ferns unknown to science. Experience with South American plants leads one to expect not less than 2,000 species for an area of such size, while Tate collected only about 400. If the same proportion of unknown species continues, there are probably more than 500 unknown kinds of plants still awaiting discovery on Duida alone. No less than 207 species of plants find their only known home on higher altitudes of Roraima and this number will probably be doubled by adequate exploration.

Between these two mountains lie the unexplored parts of the Pacaraimas, with a flora which may be conservatively estimated to contain 4,000 different kinds of plants. Those from the lowlands will probably be mostly well-known species, but the higher elevations contain possibly a thousand or even more species still unknown to botanical science. Naturally we can not even guess

what these plants will be, but we may logically expect to find among them many of great scientific or horticultural interest, if they follow the precedent set on Roraima and Duida.

Persons whose experience with plants is limited to the United States do not always appreciate one of the fundamental features of plant distribution in the tropics, which I may illustrate by comparison. Westchester and Putnam counties, New York, each have a native flora of approximately a thousand species, and of this thousand, all but a very few are found in both counties. There are comparatively very few plants found in one county but not in the other, and in general the flora is uniform throughout both. In the tropics, on the other hand, an area of equivalent size will shelter about twice as many species and there will be a great difference between adjacent areas. This is particularly true in a mountainous region, where every summit has its own endemic species. We already know that the principle holds for the Pacaraimas. A few of the Roraima species occur on Duida, but each peak has a very large proportion of species known from the one mountain only. Undoubtedly the same condition prevails on all of the unknown and unexplored mountains which lie between them, and which will be the field for the expedition.

What is the value of such exploratory work in a region so far from civilization, so completely remote from any of our ordinary American activities? Each line of work which the expedition proposes to carry on has its own important features, such as the mapping of the longest unsurveyed boundary in America by means of aërial photography, but the botanical results may be anticipated under five general heads. First, it is the duty of botanical science to make known the plant life of the world, and here is a region as large as Maine whose plant life is completely unknown. Secondly, the collection of these plants will throw light on the nature of evolution in general. The different forms of plants on the various mountains show the direction which evolution takes and by comparison give some idea of what their ancestors were. Third, a better knowledge of the plants and animals together will aid the geologist in reconstructing the past geological history of the country, which at present is also unknown. There is a theory that these mountains were once continuous across the Orinoco valley westward to the Andes. If the

flora shows a considerable proportion of plants with Andean affinities, this theory will be much strengthened. Fourthly, the plants include many highly ornamental species which will be a distinct asset to American horticulture, either grown under glass in the northern states or in the open in Florida and California, and every effort will be made to get seeds, roots, or cuttings of many of these back to New York for cultivation or propagation. If sufficient funds become available, an expert horticulturist will be attached to the expedition for this particular purpose. Fifthly, there is always the possibility of discovery of new and valuable medicinal plants, now in use by the Indians but still unknown to medical practice.

Space does not permit a discussion of further details of this remarkable flora, and a single example must suffice. The largest pitcher-plants in the world, so far as known, grow in the Pacaraimas, one kind on Roraima and three other kinds on Duida. Possibly still others will be found somewhere between these two mountains. The Duida species are the larger, standing as much as five feet tall with flowers five inches in diameter. The pitchers have a little hole in the side about half way from bottom to top, so that the water which they always contain never rises beyond this level. In another year we hope to see some of these remarkable plants growing in the greenhouses of The New York Botanical Garden.

H. A. GLEASON.

BEGONIAS AS HOUSE PLANTS[1]

Begonias make ideal house plants, because some varieties enjoy a sunny window, and others are quite content with little or no sun. They bloom at different seasons, also, so one may plan for a succession of bloom by growing a number of varieties.

The begonia was named for Michel Begon, a French botanist who lived on the island of Santo Domingo from 1638 to 1710. There are from four hundred to five hundred species in the warm countries of the world, a great many being found in Central and South America.

[1] Abstract of a lecture given March 14, 1931, at The New York Botanical Garden by the Corresponding Secretary of the National Council of State Garden Club Federations

The best soil for begonias is a light, porous one, composed of two parts sandy loam, one part sand, one part old leaf-mould, and one part old cow-manure. This should be thoroughly mixed. If it is not possible to get these materials, any greenhouse man will sell properly mixed soil.

Begonias should be watered sparingly, for they do not like wet feet. Some fresh air should be admitted every day, but direct draughts should be avoided, as this will cause the leaves to drop. If the air is hot and dry, this, too, will cause falling leaves. There are various ways of humidifying the air, the simplest and best being a constantly steaming tea kettle. (Incidentally, this will prevent the furniture from cracking, and the family will be less apt to have head colds.) Pans of wet gravel may be kept under the pots, and dishes of water set on the radiators will help to keep the air moist.

The best time to propagate begonias is in the spring, when cuttings may be rooted in moist sand. A home substitute for a greenhouse propagating bed may be made from a Wardian case, an aquarium with a sheet of glass for a cover, or a glass display jar partly filled with sand. Set this jar in a sunny window, so that the sand may become warm, but shield the cuttings with a paper or cloth. Care must be taken to admit some air when steam appears on the glass. After the cuttings are well rooted, which usually takes three or four weeks, they may be transplanted into small pots of soil.

The blooming varieties need a sunny window, but the Rex and spotted-leaf varieties grow nicely in a north window. For house plants, winter-blooming kinds are most desirable. The *semperflorens,* true to name, blooms constantly. *Nitida,* the oldest begonia, was introduced into England in 1777 from Jamaica. This, as well as its fragrant seedling, *odorata alba,* has smooth green leaves and white flowers. *Rosea gigantea* is a seedling of the *semperflorens,* with large, glossy, green leaves and great sprays of rose-red flowers, freely produced. It begins to bloom about Christmas, and is constantly in flower for many months.

Schmidtiana, a Brazilian species, has small, grayish-green, velvety leaves, red underneath. The small, white, pink-tinted flowers are both plentiful and constant. *Templinii* is another excellent winter-bloomer. This is a tall shrubby variety with beauti-

fully mottled leaves of green and cream-yellow, with rose tints. The large trusses of flowers are rose pink. This needs a sunny window.

For the north window, we may choose the old favorite, *argentea guttata*—the "trout begonia" our grandmothers called it—or any of the spotted-leaf varieties. The so-called "star" begonias—*B. heracleifolia* and its seedlings—do well in a north window, although a little morning sun is enjoyed by any begonia. This plant, with its deeply cut dark-green leaves and red-spotted, hairy stems, is handsome at any time, but when the tall sprays of rose-pink blooms come, from January to March, it is the joy of all beholders. *Haageana* is a tall, shrubby begonia, a native of Brazil, the best known of the red-hairy type. It is very hardy, and a good bloomer. It has big trusses of waxy white flowers, with a few red hairs on the under side of the petals. *Pres. Carnot* and *Mme. de Lesseps* will both thrive in a northeast window. Both make tall, shrubby plants that bloom well from January on. They are somewhat alike in leaf, but *Carnot* has bright carmine-red flowers, and *De Lesseps* white, pink-tinged.

In hanging pots, we may grow *manicata aureo-maculata,* of large, smooth, waxy leaf of light green with blotches of yellowish white, tinged with pink. It begins to bloom in February with feathery sprays of tiny, pale-pink flowers. This begonia needs a sunny window, but *Begonia glaucophylla,* with small, shiny, green leaves and brick-red flowers, will do well in a northeast window. This begonia may be grown on a trellis or in a hanging pot, as it is quite vine-like. It is a native of Brazil, and a good winter-bloomer. *Begonia foliosa* may also be grown in a hanging pot in a north window. It comes from Colombia, and might well be taken for a fern. The insignificant white flowers hang from the axils of the leaves, under the flat, fern-like sprays.

The most difficult part of begonia culture is to get the begonia. Florists say frankly that they are slow sellers. And people seeking the choicer varieties say it is useless to go to the florists, as they carry only a few of the old varieties. But the demand of the amateur becomes, in time, the mainstay of the florist's business. So if we keep on demanding begonias—and buying them the florist will hunt them out and grow them for us, and we shall all be happy.

BESSIE W. BUXTON.

FIGURE 1. *Castalia odorata* in a pineland pond in southern Mississippi. From early spring until fall all sizes of ponds may be thickly populated with this water-lily. It makes up in the number of flowers what it lacks in the size.

THE WATER-LILIES OF THE UNITED STATES[1]

Water-lilies are now horticultural subjects, some of them very attractive, but for many centuries before their horticultural vogue, these plants were esteemed from a culinary standpoint. The aborigines made use of both the rootstocks and the seeds for food.

Since water-lilies are suggestive of wet country, we are not disappointed in finding on the Atlantic and Gulf Coastal Plain, the ultimate drainage land of the interior highlands, a considerable development of aquatic flowering plants.

These aquatics occur in sizes ranging from the gigantic *Thalia* to the almost microscopic *Wolffiella.* Some are firmly anchored in the mud, others are free-floating. Some grow only in still water, others in flowing water. Some thrive in deep water, others in shallow water, while some readily adapt themselves to quite sudden changes in the water level. Some have erect leaves and flowers, others have floating leaves and flowers, while still others have floating leaves and erect flowers. Some are floriferous and fructiferous; others are completely barren. Some are active throughout the year; others are dormant for a period during each year. Some have rather small flowers; others have both large and attractive and even showy flowers.

Following is a table of the species native in the United States:

Castalia ampla (white or pink-tinged)—southern Texas (*Mexico* and *West Indies* to *Brazil*).
Castalia elegans (blue or pale-violet)—southern Florida and southern Texas (*Mexico*).
Castalia flava (yellow)—Florida.
Castalia lekophylla (white or pinkish)—southern Georgia and Florida to Louisiana (*West Indies, Mexico.*)
Castalia mexicana (yellow)—southern Louisiana and Texas (*Mexico*).
Castalia minor (white or pink)—Florida to Louisiana, and New Jersey.
Castalia odorata (white or pink)—Florida to Louisiana, Manitoba and Nova Scotia.
Castalia tetragona (white)—southern Canada to northern Idaho.
Castalia tuberosa (white)—New Jersey and Oklahoma to Michigan and Vermont.

[1] The following notes and illustrations were made possible mainly by exploration carried on through the interest of friends of the Garden.

There are eight or nine species[2] of *Castalia* in North America north of Mexico. About half of them are confined to the Atlantic and the Gulf Coastal Plain, while the other half occur in various plant provinces, some of them also in the Coastal Plain.

The geographic range of the extra-Coastal Plain species in the United States is often erratic. For example, *Castalia tetragona,* which ranges nearly across southern Canada, reappears in northern Asia and ranges southward to the Himalaya mountain region.

On the other hand, *Castalia ampla,* which occurs in southern Texas, ranges southward through Mexico and the West Indies to Brazil.

Of the three extra-Coastal Plain species, *Castalia odorata* (FIGURE 1), the common water-lily, has the widest range—growing naturally from Florida to Louisiana to Manitoba and Nova Scotia. *Castalia tuberosa* ranges from New Jersey and Oklahoma to Michigan and Vermont. The geographic range of the third species, *Castalia minor,* as far as we know it, extends from Florida to Louisiana and New Jersey. White or pink flowers comprise the variety in these more generally distributed waterlilies. The species confined to the Coastal Plain show the variety of the other group, and in addition more color—cream, yellow, and purple and more variety in habit. *Castalia ampla,* a species with white or pink-tinged flowers, ranges from the tropics of Brazil and the West Indies through Mexico up to the Rio Grande region of Texas. One of the outstanding species of the Gulf States –following by color (pink) or lack of color (white) is *Castalia lekophylla* (FIGURE 4) (*C. reniformis* Nash, not Walter). It has the largest leaves and the largest flowers of all the North American species. It ranges from Florida and southern Georgia to Louisiana (and Texas?), through the West Indies and Mexico, and apparently into other parts of tropical America.

Now for a change of color. In *Castalia flava* (FIGURE 2) and *C. mexicana* we find cream-colored and yellow flowers. Our studies have not yet let us decide whether these two names represent distinct species or a single species. *Castalia flava* came originally from Florida, while *C. mexicana* was described from Mexican specimens. This geography is also represented in *Castalia elegans* (FIGURE 3), which was recently discovered in south-

[2] Nine species, if *Castalia flava* and *C. mexicana* are distinct.

FIGURE 2. *Castalia flava* in a pond near the Tomoka River, Florida. This plant is often very vigorous, as is evidenced in the picture by the emersed leaves and flowers. The corolla is yellow.

FIGURE 3. *Castalia elegans* in a pond in the Big Cypress Swamp near the Royal Palm hammocks. This purple-flowered water-lily was overlooked in Florida until 1929. It flowers in the summer.

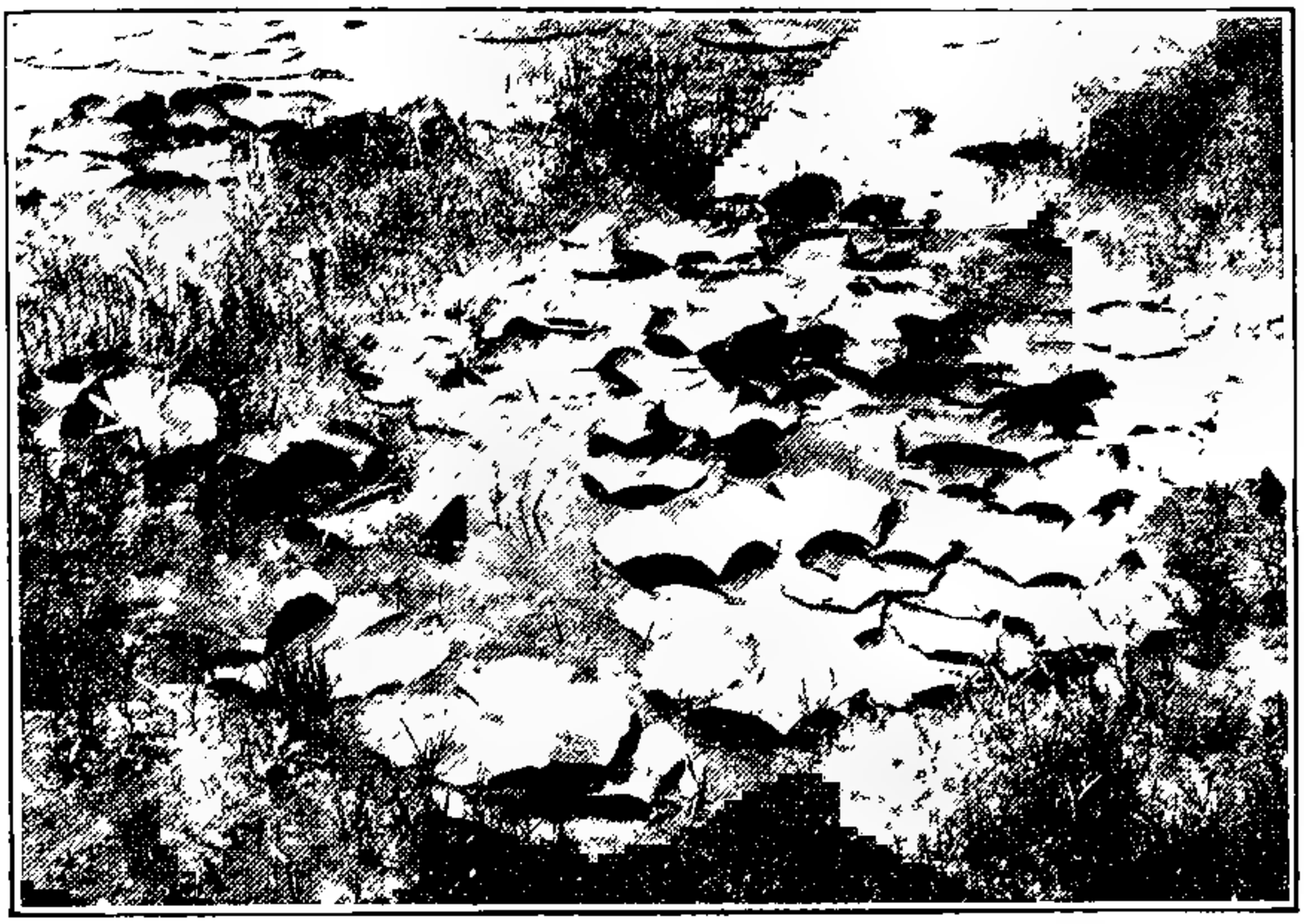

FIGURE 4. *Castalia lekophylla* in a pond near Tallahassee, Florida. This is our largest-leaved and largest-flowered water-lily. The leaf-blades measure up to about two feet across, frequently turning up their edges after the manner of "Victoria." The white flowers often measure nearly a foot across the corolla.

ern peninsular Florida. Otherwise it grows naturally in southern Texas and in Mexico. An additional color appears with this plant, a blue or pale-violet.

These aquatics occupy either still or flowing water. For some reasons they have developed habitat characteristics. The white-flowered species have, as a rule, floating leaves and floating flowers. *Castalia lekophylla* sometimes elevates its large flowers above the surface of the water. In the yellow-flowered species, for some reason, the leaves and the flowers may be either erect or floating. The purple-flowered species, *Castalia elegans,* in Florida, at least, is stable in character of having floating leaves and well-elevated flowers.

The genus *Castalia* is characteristic of both boreal and temperate regions in the United States. The northern plants are thoroughly hardy and grow well during their short season. The southern plants with a growing season represented by the whole year –although the plants have more or less of a resting season —often grow with astonishing luxuriance.

JOHN K. SMALL.

NOTES, NEWS, AND COMMENT

A photostat has recently been purchased by the Botanical Garden and will soon be in operation. Its cost has been covered by a special grant from the Carnegie Corporation.

The Gardeners' Chronicle of February 7 carries an appreciative biographical sketch, with portrait, of Dr. A. B. Stout, Director of the Laboratories of The New York Botanical Garden. It reviews his work with diseases of lilies, in hybridizing daylilies (*Hemerocallis*), in breeding seedless grapes, in discovering synchronous and reciprocating dichogamy in avocados, in investigating sterilities of various plants, etc. On another page of the same issue is a discussion of "The diseases of lilies," based largely on the results of Dr. Stout's studies and illustrated by photographs furnished by him.

Instead of attempting the well-nigh impossible task of trying to pick out ten or twelve days in advance the one day on which The New York Botanical Garden's display of Narcissus flowers might be expected to be at its climax and calling it "Daffodil Day," the management this year issued to the members and friends of the Garden a card announcing that the collection was expected to reach its general climax of beauty in the period between April 20 and April 30. There is a spread of about a month between the blooming of the earliest and the latest of the 150 varieties in the collection, so that not all of the varieties can be found in bloom at any one time. The naturalized plantings, designed by Mrs. Wheeler H. Peckham, now cover four to five acres and it is probable that this year's display included nearly a half million individual flowers.

Meteorology for April. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 65° F. on the 4th; 69° on the 11th; *76° on the 18th;* and 71° on the 21st. The minimum temperatures recorded were: 37° on the 3rd; *32° on the 12th;* 37° on the 16th; 35° on the 24th; and 34° on the 30th. The total precipitation for the month was 3.45 inches.

ACCESSIONS

Museums and Herbarium

80 specimens of plants from the Marquesas Islands. (By exchange with Mr. E. P. Mumford.)

12 specimens of flowering plants from the northeastern United States. (Given by Dr. J. A. Drushel.)

200 specimens of flowering plants from the West Indies. (By exchange with the Riksmuseum, Stockholm.)

984 specimens of plants from New Caledonia. (Given by Dr. E. D. Merrill.)

89 specimens of plants from Kwangtung, China. (Given by Dr. E. D. Merrill.)

954 specimens of plants from Kwangsi, China. (Given by Dr. E. D. Merrill.)

103 specimens of plants from Anhwei, China. (By exchange with the National University, Nanking.)

558 specimens of plants from Yunnan, China. (By exchange with the Edinburgh Botanic Garden.)

99 specimens from Malaya. (By exchange with the Singapore Botanical Garden.)

111 specimens of Chinese plants. (Given by Dr. E. D. Merrill.)

1 photograph of *Solidago* sp. from Ft. Meade, Florida. (Given by Mr. W. M. Buswell.)

106 specimens of Philippine ferns. (By exchange with the University of California.)

2054 specimens of Chinese plants, the Bonati herbarium. (Given by Dr. E. D. Merrill.)

1485 specimens of Philippine plants. (Given by Dr. E. D. Merrill.)

120 specimens of H Handel-Mazzeti Chinese plants. (By exchange with the Vienna Museum of Natural History.)

1223 specimens of plants from Sumatra. (Given by Mr. H. S. Yates.)

305 specimens of plants from Borneo. (Given by Mr. D. D. Wood.)

83 specimens of plants from the Fiji Islands. (By exchange with the British Museum.)

85 specimens from Rarotonga. (By exchange with the University of California.)

225 specimens of Chinese plants. (Given by Mr. C. Y. Chiao.)

156 specimens of Yunnan plants. (By exchange with the Vienna Museum of Natural History.)

119 specimens from Kwangtung, China. (Given by Dr. E. D. Merrill.)

60 specimens of Asiatic plants. (By exchange with the Singapore Botanical Garden.)

2 specimens of Cuban mosses. (By exchange with Brother León.)

12 specimens of mosses. (By exchange with Rev. C. H. Demetrio.)

6 specimens of plants from Venezuela. (By exchange with Mr. Henri Pittier.)

8 specimens of mosses from Jamaica, West Indies, and Costa Rica. (Given by Mr. Edwin B. Bartram.)

2 specimens of mosses from China. (Given by Mr. A. P. Jacot and Mr. George Marshall.)

4 specimens of mosses from Maine. (Given by Mr. and Mrs. Frank E. Lowe.)

5 specimens, types of moss species. (By exchange with the Botanical Garden, Dahlem, Berlin.)

2 specimens of mosses from South Dakota. (By exchange with Mr. A C. McIntosh.)

1 specimen of moss from Peru. (Given by Professor F. L Herrera.)

1 specimen of moss from Washington. (Given by Miss Patchin.)

13 specimens of mosses from England, Scotland, and Wales. (Given by Mr. J. Burtt Davy.)

4 specimens of mosses from Texas, Costa Rica, and Jamaica. (Given by Mr. Edwin B. Bartram.)

4 specimens of Peruvian mosses. (By exchange with the Field Museum of Natural History.)

9 specimens of mosses of Michigan and Wisconsin. (By exchange with the Field Museum of Natural History.)

9 specimens of mosses from Louisiana, Arizona, New Mexico, Mexico, and Jamaica. (By exchange with Mr. Edwin B. Bartram.)

25 specimens, "Musci Americani Perfecti," nos. 126–150. (By exchange with Dr. A. J. Grout.)

66 specimens of flowering plants from Samoa. (Given by Dr. E. D. Merrill.)

87 specimens of Malayan plants. (By exchange with the Singapore Botanical Garden.)

281 specimens of Siberian plants. (By exchange with the University of Tomsk.)

146 specimens from Nanking Province, China. (Given by Dr. E. D. Merrill.)

132 specimens of Formosan plants. (By exchange with Dr. T. Tanaka.)

1209 specimens of plants from Borneo. (Collected by Dr. A. D. E. Elmer.)

45 specimens of plants from Kwangtung, China. (Given by Dr. E. D. Merrill.)

1705 specimens, "Filices Exsiccatae." (Distributed by Rosenstock.)

18 specimens of Mexican mosses. (By exchange with Brother León.)

6 specimens of mosses from Tennessee and Mississippi for naming. (By exchange with Rev. C. H. Demetrio.)

173 specimens of mosses from Peru. (By exchange with Professor F. L. Herrera.)

5 specimens of Pentstemon from North America. (Given by the Carnegie Institution.)

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 41,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———

Conditional bequests may be made with income payable to donor or any designated beneficiary during his or her lifetime.

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JOURNAL
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JOHN K. SMALL

ROCK GARDENING WITHOUT A ROCKERY
ETHEL ANSON S. PECKHAM

PLANT LIFE AROUND NEW YORK AS STUDIED BY THE TORREY BOTANICAL CLUB
RAYMOND H. TORREY

ECOLOGICAL RELATIONS OF PLANT COMMUNITIES
W. G. WATERMAN

NOTES, NEWS, AND COMMENT

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THE CYPRESS, SOUTHERN REMNANT OF A NORTHERN FOSSIL TYPE*

Despite the destructive agencies active in later geologic periods, which have robbed us of much vegetation of which we have barely a trace, there remain a few species of *Taxodium,* or, in common parlance, cypress, as a relic of earlier ages in America.

The cypress is an ancient type of plant. Evidence furnished by the underground parts indicates a long history of growth in wet situations, and today the natural habitats continue to be low, and in some cases permanently very wet.

The past experiences of these species have hardened them so that the trees usually survive, and often thrive, when transplanted to localities quite different from their present natural habitats or to latitudes north of their present areas of distribution. Considering its rather soft wood, this tree has exceptional lasting qualities in contact with soil and weather, and for this reason it has been termed the " wood eternal."

The genus *Taxodium* has survived in the present geologic period as three species. They are naturally confined to the southeastern United States and eastern Mexico. Unlike some of the survivals or remnants from more recent geologic times, these plants have no generic representatives in western America or eastern Asia, although a close family relative exists in *Glyptostrobus* of eastern Asia.

* The following notes and illustrations were made possible by exploration carried on mainly through the interest of friends of the Garden.

FIGURE 1. A small river-cypress (*Taxodium distichum*) along the shore of Lake Okeechobee, Florida. The humus deposit has been burned from about its base, thus exposing the root-system with the "knees" strongly developed.

The botanical history of these cypresses begins with the publications by Linnaeus of *Cupressus disticha* in 1753.[1] This species was finally put in its proper place—*Taxodium distichum*—by L. C. Richard.[2]

Less than a decade later another cypress was brought to light by Thomas Nuttall[3] and treated as a subspecies under the designation *Cupressus disticha imbricaria.*

About fifteen years later this plant was named and described as a species under the name *Taxodium ascendens* by Adolphe Brongniart.[4]

After a score of years the third, and apparently final chapter of *Taxodium,* from a specific standpoint, was written in the publication of *Taxodium mucronatum* by Michele Tenore.[5]

Thus the fundamental botanical history of the cypress was confined to one century (1753 -1853) and is apparently closed. However, the genus had several careers previous to this one, in the archaic and pre-Linnaean eras.

Pre-botanical History

Taxodium is an ancient type of which the three existing species represent mere remnants. Fossil plants referable to this genus were widely scattered in north temperate and arctic regions in the Tertiary period. Specimens have been found in the strata of North America, Europe, and Asia, even as far north of the Arctic Circle as Spitzbergen.

Pre-linnaean History

Observations made previous to the middle of the eighteenth century are variously recorded in a number of old works. For example:

"There is a kynd of wood we call cypress, because both the wood, the fruit, and the leaf, did most resemble yt; and of these trees there are some neere three fathome above the root very streight, and fifty, sixty, or eighty foote within a braunch."[6]

[1] Sp. Pl. 1003. 1753.

[2] Mem. Mus. Paris **16**: 298. 1810.

[3] Gen. **2**: 224. 1818.

[4] Ann. Sci. Nat. I. **30**: 182. 1833.

[5] Ann. Sci. Nat. Bot III. **19**: 355. 1853.

[6] William Strachey, Historie of Travaile into Virginia Britannia, ed. Major, 129.

FIGURE 2. A cypress strand (*Taxodium ascendens*) in the Big Cypress Swamp, Florida. The trunks have paler bark than in the river-cypress. They are often nearly white. The root-system produces fewer and smaller "knees" than that of the river-cypress.

". . . Four or five feet round this tree, (in a singular manner) run many stumps [knees], some a little above the ground, and others from one to four feet high, of various shape and size, their tops round and with a smooth red bark. These stumps shoot from the roots of the tree, yet they produce neither leaf nor branch,[7] . ."

"Grows in Virginia, most abundantly, where these, Liriodendrum and Platanus are the largest of all the trees of this region."[8]

Observations made about the borderline of pre-Linnaean and post-Linnaean periods are recorded thus in quite flowery language:

"The *Cupressus disticha* stands in the first order of North American trees. Its majestic stature is surprising, and on approaching them, we are struck with a kind of awe at beholding the stateliness of the trunk, lifting its cumbrous top towards the skies, and casting a wide shade upon the ground, as a dark intervening cloud, which, for a time, precludes the rays of the sun. The delicacy of its color, and texture of its leaves, exceed everything in vegetation."[9]

Geographical Distribution[10]

The combined geographic distribution of the three species is extensive, at least in a linear way. That is, it comprises the Coastal Plain and adjacent provinces of the Gulf of Mexico, and the Atlantic Coastal Plain from Florida to southern New Jersey.

The river-cypress or bald-cypress (*Taxodium distichum*), the oldest cypress, botanically speaking, exceeds the other two species in extent of area. It ranges from southern peninsular Florida through the Gulf Coastal Plain to eastern Texas, southern Missouri, and southern Indiana, and in the Atlantic Coastal Plain to southern New Jersey. Its typical habitats are along rivers and in river swamps.

[7] Mark Catesby, The Natural History of Carolina, Florida, and the Bahama Islands, 1: 11. 1731.

[8] Linnaeus, Hort. Cliff. 449. 1737.

[9] William Bartram, Travels through North and South Carolina, Georgia, East and West Florida, 88. 1793.

[10] R. M. Harper has discussed *Taxodium distichum* and *T. ascendens* extensively in Bull. Torrey Club **29**: 383–399, and **32**: 105–115. The following notes and illustrations have been made possible as a result of exploration carried on through the interest of friends of the Garden.

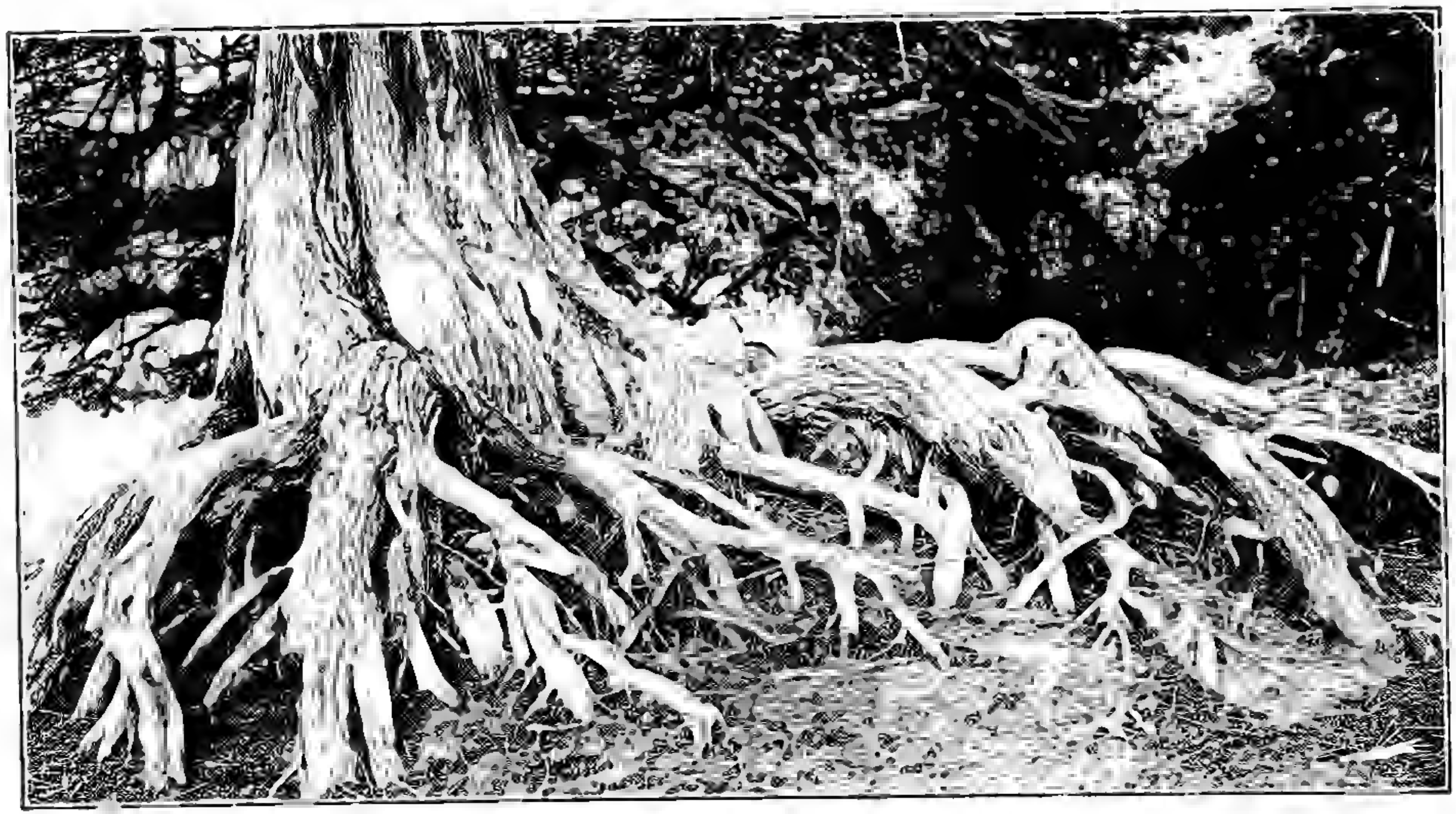

FIGURE 3. The Mexican cypress (*Taxodium mucronatum*) growing along a resaca of the Rio Grande below Brownsville, Texas. With the soil, clay in this case, washed away, the lack of "knees" in the root-system becomes evident.

The second "botanical cypress," the pond-cypress (*Taxodium ascendens*), may be the older biological species or it may be the younger. However, its range is less extensive than that of the river-cypress. It ranges, in the Coastal Plain, from southern peninsular Florida to Mississippi (or Louisiana) and to southern Virginia. Its typical habitats are flatwoods, cypress heads, and branch-swamps.

The two species mentioned above are strictly temperate-region plants; the third species, the Mexican cypress (*Taxodium mucronatum*), ranges from the tropical zone of Mexico northward into southern Texas. Its typical habitats in Texas are borders of resacas.

Technical Characteristics

The outstanding characteristic of cypress, at least in the two earlier-described species, is its root-system. Following the rule of trees growing in wet or in damp places where the water-table is near the surface of the ground, the roots spread out horizontally. They do not penetrate below the normal water-table. From these roots arise erect "knees," conic structures up to twelve feet tall and a foot or more in diameter at the base. Their tissue is firm on the outside, but somewhat spongy within. The root-system of the Mexican cypress seems to lack the conspicuous "knee" development. However, the roots spread horizontally under the ground or on the surface.

The aërial technical characters of the three species are interlacing; that is, the three species are related by intertwining technical characters. The river-cypress and the Mexican cypress are related through a conic sharp-ridged trunk and by the foliage. The leaves, although spirally arranged, are elongate and spread distichally in a dorso-ventral manner, thus giving the branchlets the appearance of pinnately compound leaves. In the pond-cypress, the conoidal base of the trunk has rounded ridges and the leaves are spirally arranged and short, erect, and closely appressed to the branchlets, thus in no way conspicuous. The branchlets do not resemble compound leaves, but are string-like. This leaf character is duplicated in the two Sequoias, the redwood and the big-tree, of the Pacific Coast region.

Another set of characters aligns the species differently. By

the cones the river-cypress and the pond-cypress are grouped together against the Mexican cypress. In the two former species, the cone-scales have several marginal tubercles and a more or less prominent ridge across the face; in the latter species the cone-scales have fewer marginal tubercles, and a facial mucro. The leaf-characters make the same alignment of the species. In the pond-cypress and the river-cypress the leaves are deciduous, so they are "evergreens" that are not evergreen. In the Mexican cypress the leaves are persistent and the tree is truly evergreen.

Size of the Trees

The interlacing characteristics might be continued by mentioning the size of the trees. The pond-cypress does not become a large tree, and is, perhaps, the shortest-lived of the three; on the other hand, the river-cypress and the Mexican cypress may attain great age and often become very large. Although the river-cypress has reached a maximum trunk-diameter of more than twelve feet, the Mexican-cypress holds the record. The largest cypress tree on record is in Tule, Mexico. In this tree, five feet above the ground the actual girth of the trunk is one hundred and four feet, while following the sinuosities caused by the buttress-like ridges, the circumference is one hundred and forty-six feet. The trunk is not cylindric and the greatest diameter is about forty feet, while the spread of the branches is about one hundred and forty-one feet.

Commercial Field for Cypress

Their great abundance, the large size of the cypress trunks, the place of growth along water-courses and in swamps, and the demand for the lumber, have all conspired to lead the tree into terrific slaughter. The best of the natural growth has been cut and destroyed, yet in the remote parts of the Southern-Atlantic and the Gulf coastal plains, lumber-mills and towns still spring up in the wilderness almost overnight, and in a short time one will find acres of stacked lumber ready to be shipped to distant points.

Although dried cypress wood is comparatively light, when freshly cut it will sink in water. Consequently, the lumberman

FIGURE 4. A Seminole Indian dugout-canoe in the Everglades west of Miami, Florida. This is one of the primitive uses of the cypress. The canoes are made from trunks of the river-cypress, secured from along rivers or from sloughs, such as the Okaloocooche Slough.

FIGURE 5. A canoe made and used by the aborigines of southern Florida, dug from the tidal marsh on the reservation of George P. Brett, near Cocoanut Grove, Florida. This boat shows the use cypress was put to centuries ago. It is quite a different model from the Seminole canoe shown in FIGURE 4. In fact, it was made and abandoned perhaps centuries before the Seminoles, as such, existed, for the Seminoles are deserters from the Creeks of Alabama and Georgia, as the word Seminole implies.—Photograph by George P. Brett.

must "girdle" the trees and let them die before felling them. The apparent sinking of the land of the Gulf Coastal Plain aids and abets the lumberman, by causing almost continuous aquatic conditions by which the dead logs may be floated out of the swamp. On the other hand, this high water-table seems to be detrimental to the reforesting of the swamps with cypress, for there are, apparently, no suitable places for the seeds to germinate and grow. This is one of the several different classes of evidence of the subsiding of the Coastal Plain furnished by the vegetable kingdom.

HOW THE WOOD IS USED

On account of its many good qualities cypress wood is used in all classes of modern construction, from the rough exterior to the highly finished interior. Its primitive uses are also continued, mainly among the Seminole Indians of southern peninsular

Florida. They employ it in the construction of their camps, for fence-posts, stockades, habitations, fuel, etc. The pioneer white-man naturally uses it in similar ways; the Indian, however, has a unique use for it in the construction of his canoe. This as a means of transportation is not only useful, but essential. This canoe is constructed from a single cypress log, usually of the river-cypress. It is called a dugout or, in Indian parlance, *bith-low*. Considering its length, beam, and cubic capacity, this boat is a marvel, for in it an Indian will carry his family—squaw and several children—camp-outfit, wardrobe, food-supplies, pigpen with pigs, chicken coop with chickens or other fowl, dogs, etc., for long distances, over shallow and deep waters, even rough water, without a mishap!

JOHN K. SMALL.

ROCK–GARDENING WITHOUT A ROCKERY[1]

This sounds like a paradox and, like a paradox, it is a simple affair which is often made to appear as complicated as possible. The way one gets the better of such a thing is to take it apart, being careful to lay the pieces in proper order and not confuse them, then put it all together again so we can understand it. Like most really good mechanics, we leave out something which, in the process of a "commonsensical" application of elementary principles, we suddenly discover is quite unnecessary!

And so we get to our rock-gardening, using the sound principles of good rock-garden horticulture and rock-garden material of soils, large and small stones, rubble, good drainage, and alpine and other low-growing plants. But, instead of concentrating this garden in one definite spot, as we do where we have a naturally rocky outcrop or where we are foolish enough to make a mountain (or a mole-hill) in a level, unstony country, we apply our rock-gardening to various locations which appear convenient to be so treated.

Now, we know that in rock-gardens unusual and "difficult" plants can often be grown because they may be given some special treatment of soil, good drainage, or an immense amount of

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, March 7, 1931.

hot sun, while roots may be deep in a cool place under a rock. We know this is achieved by making "pockets," or particular gardens, for each group of plants, studying and providing for their special needs. We may spread or limit the size of these definite little gardens to suit our taste or the exigencies of the occasion.

We also know that the basis of success in horticulture is to give a plant the treatment and situation it likes and then let it alone to enjoy itself. All this can be done in our rock-gardening, whether in a rockery or not. Where we make the first mistake is in not using enough rock-garden plants in places other than the rockery, and these places are not few in number if we keep our eyes open. There are many ways of spoiling such places in gardens—having everything plastered over with cement, for example. Nature does not smooth all edges; in fact, edges are usually a rubble of small stones and the smooth places are those swept by strong winds or the wash that has taken down those very stones.

We are apt to have walks or driveways edged with a curb, often of cut stone, quite formal and occasionally the bane of the owner, though it may be a real convenience in that it upholds the soil of a flower-bed. This may look very well exposed in all its rigidity and harshness in certain places and in certain styles of gardening, but in the general run of things it is an affair to combat, and "rock-garden" plants are the ones to do it with. Then, again, even in the formally treated garden design where there is a bank one side of a path, it may be set with rocks slanted out at the bottom, in at the top, as in a little dry wall, and it may be planted with one kind of plant, such as the border of Cerastium in a well-known garden on Long Island. This gives two effects during the year, a mass of white when in bloom and a mass of silver-gray foliage the rest of the year.

Most pieces of land, when we start to garden, are uneven. We may see the ground leveled off and poor grass growing thereon, but if we prefer a garden different from those of our neighbors and we discover, with the aid of a crowbar, that there is rock close to the surface in some places, we can dig the soil away, taking it somewhere else where we need very deep soil. We can often, then, have just a ledge, an edge of rocks, perhaps near a

lawn; or, maybe our neighbor's place is rocky and high, while ours is low, and we can do our rock-gardening at the foot of his real rock-wall. The bank on a boundary may often be utilized as a small rock-garden with a rock-edged pool set below. It may not be possible to have a real wall all the way up. There may have to be a hedge on top, or the bank may be planted with creepers which are allowed to ramble at will. The application of the correct way to lay the stones so our winter frosts will not make the bank slide and so the effect from the front will be that of a natural wall of stone, will make all the difference in the world to such a corner of rock-gardening. The bank should be cut away and the stones laid in front, leaving a gap behind which is to be gradually filled, as the stones are laid, with one third rich garden loam, one third well-rotted leaf mould, and the remaining third of small stones and sand. This gives good nourishment to the plants, for their roots will go back into it. They may be set as the wall is built or, if several inches of soil are put between the layers of stone, they may be stuffed into the chinks later.

There should also be paths from one level of the garden to another, sometimes passing under trees and sometimes meandering in full sun. They may be just on the edge of real rock outcroppings or they may be made to look as if they were. Some of us have paved gardens where all paths and spaces between flowerbeds are treated with stone. Here rock plants may border the beds and sprawl at will over the edges of the paths and here more dwarf plants may fill the interstices between paving. To start plants between paving, it is often a good idea to sow seed, and always it should be remembered that plants in paving should be few and far between and of very low stature, rarely taller than thick moss would be. The taller plants should be kept for the sides.

Many people think that bulbs are out of place in rock gardening, but there are plenty of bulbous plants which grow naturally and enjoy such locations. Grape hyacinths, scillas, and crocuses are among those which do well even at the edge of paving, if properly placed. Frequently the only paving in a garden is a short walk or terrace leading to the house door, and a clever planting on the edge of this to bloom during several months and

combine with the flowers in the bed behind will make a charming place of what is usually humdrum.

Instead of making a dry wall against a bank, a few very large stones may be set together to form a wall face, and patches of different plants can be set at the foot between the rocks and the path. Hanging rock plants such as phloxes, aubretias, etc., may grow on the top to clamber down between the stones. One can do wonders with a patch of small bulbs like scillas or snowdrops set with a sedum or two and some dwarf iris adjacent, with one of the new hybrids of *Phlox amoena* or *P. subulata* for the top and chinks. Endless combinations may be made on the order of that with the pale yellow of *Alyssum saxatile* "Lemon Queen," blue grape-hyacinths, *Sedum Sieboldi,* white autumn *Crocus speciosus,* and dwarf bearded-irises, perhaps "Naomi" (yellow) or *Chamaeiris Campbelli* (blue).

We are all familiar with the herbaceous border on the edge of the lawn and know that low plants are required towards the front. We are apt to treat the length of a bed in a monotonous manner, making the edging of the same plant all along, forgetting that we can introduce two or three large stones here and there to make a hump whereon a colony of houseleeks will thrive. We can raise the edge at places and vary our border considerably. If we do, we must remember that the plants behind must not droop or lie over the edging plants, neither must they bend and drip upon them. Rock plants object very strongly to much water from above. And they also object to lawn-mowers. To prevent the tips of the leaves from getting cut off, a band of earth must show between lawn-edge and plants. Sometimes there are paved paths, then grass borders, then flowers. This looks grand but needs much care and I would prefer rock-plants to the grass. Brick paths with grass edges are even worse, especially if the grass is narrow. In the tiny formal garden an edging of bricks laid lengthwise or one of diagonal corners of bricks would look much better and be half the care. On the edges of some beds I have seen a row of paving stones set between plants and lawn. This worked finely for keeping the mower off the plants but it gave too much formality where a natural effect was desired. What is best is brick paths edged with stones, the beds raised, with rock plants among and above the stones. The paths, then,

are slightly sunken. Heavy rains will run down them and not wash into beds. Gravel paths are good, and if the beds are raised and bordered with large stones, plants may be allowed to grow out on the edges.

A narrow bed backed by the wall of a building can be built up with stones to form a sort of small bank. By making pockets of soil of different kinds—using more lime in one place and more sandstone in another, for instance rock plants demanding totally different foods may be assembled, and the whole bank can be given a pleasing design. This is a satisfactory scheme for handling "difficult" plants and is much practised in England. I have seen a border of tall bearded-irises in a strong limestone soil, a narrow gravel path, and then a long narrow border of peaty soil containing all sorts of rock-plants, heaths, and bulbs that were in a flourishing condition, while another narrow gravel path separated this low central ribbon from a herbaceous border of such things as phloxes, peonies, roses, and all those "easy" creatures which are satisfied with "ordinary garden loam."

Plants which appear, from their habit of growth, to be water-lovers and which really will not grow on the edge of water unless raised above it, are sometimes placed near streams that have a cement margin into which stones have been set, simulating a natural rocky edge. Here we can use many rock-plants, while our narcissi and Japanese or Siberian irises are set behind the concrete protection.

On the edges of our rock-garden beds which are raised, we can, if we have strong-rooted plants such as roses in the beds, take long slates and run them down into the ground lengthwise, so they do not show above the surface. This prevents the roots from spreading among the less vigorous plants and injuring them. Large flat stones, often pieces of paving, may be laid about, if it is carefully done so as not to make a set pattern, and pockets can be fashioned between them. A sort of shelf of a flat stone will many times be the delight of a family of "hen and-chickens" (*Sempervivum*), and thymes also love to spread about on such a ledge—but it must be sloped slightly, so water will not remain on it under the plants.

After the plants are put in, always sprinkle the surface of the ground between them with stone chips. One makes these by

pounding up rottenstone and one makes mortar-rubble by saving old mortar from masonry taken down and pounding it up, or one can buy it from any contractor who wrecks buildings. Often he is glad to have you take it for nothing. Anywhere that buildings are coming down is the place to find out about this and generally to procure it. Even the ends of fresh mortar left from new work may be put away in a pile exposed to the air to be used a year or so later. A good gardener keeps piles of all sorts of things waiting—piles of large stones, piles of little ones, leaf-mould, bone-meal, peat-moss, and such things. Sprinkle rubble on the surface or mix it in with soil you are preparing, and if you can get it, use broken limestone also for the plants that really are native to a limestone country.

Clinkers of pea-coal from the furnace are not objectionable, but the large clinkers are too artificial looking, and the tufa rock, so much recommended, in my opinion, is fine to keep *under the surface* where it cannot be seen. Nothing is a worse trap for the unwary, and borders bursting forth in tufa all over are soon as awful as clam-shells, cockle-shells, beer-bottles and cast-iron grape-vines. If you wish to use your old oyster- and clam-shells pound them up and use them to help the lime content of your soil.

A top-dressing of rich loam and well-rotted leaf-mould should be put on each spring and gently eased in by the use of a small hand-fork. Small stones should again be sprinkled over the surface. These prevent birds from scratching and taking dust-baths in dry weather and help to keep the leaves of the plants from getting bogged down in a spell of wet weather. Peat-moss can often be used as a mulch where plants prefer acid soil. If it is desired to retain moisture, the peat-moss is put on after a rain or a thorough watering, while if a dry condition is desired it is added after a hot dry spell, when the surface is well dried out. Watering is not necessary after the plants are established and unless it is very carefully done it does more harm than good.

Of things to remember in plant combinations, if you edge tall irises with bulbs, watch out that the irises do not grow over them; and if you use a veronica that is a rampant grower be careful it does not run into the irises in such a manner that the rhizomes do not get their proper amount of sun. Truly, if one puts plants near together, weeding means the extracting of very young

weeds as soon as they put out their second leaves and show what they are, and the ruthless thinning of plants that wish to grow over each other, letting each come close enough to fraternize but allowing no overbearing qualities to persist.

Another thing with which we must charge our memories is the planning of combinations of blooming times; of two blooming periods such as a cover-plant to bloom later than a spring-blooming bulb, and combinations of shape and style as compared with plants growing behind. We may even put prickly-pears in conjunction with crocuses if we use a species of crocus that is a dainty little thing, and there are many of these worth growing in our rock-gardens. Where we plant these little bulbs we do not dot them evenly over the space allotted to them but make a patch with some of the bulbs close together in one part and sprinkled thinner in others. We do not need to confine ourselves to spring-blooming crocuses, either, as there are many autumn-bloomers quite delightful for this purpose. In fact, so far as bulbs are concerned, we may begin very early and make numerous combinations throughout spring, summer, and autumn. *Iris reticulata,* coming with early scillas, snowflakes, and grape hyacinths at the end of March, can be preceded by snowdrops and crocuses, and will be followed by daffodils, *Scilla campanulata* varieties, species of tulips, lilies, autumn crocuses, colchicums, and sternbergias. Any good rock-garden plants as recommended in standard books on that subject may be tried in these sporadic rock-gardens. The thing to do is to buy seeds and plants from reliable sources, to study the requirements of the plants, and to supply the plants with these requirements.

ETHEL ANSON S. PECKHAM.

PLANT LIFE AROUND NEW YORK AS STUDIED BY THE TORREY BOTANICAL CLUB[1]

The territory which has been covered by the field excursions of the Torrey Botanical Club possesses one of the richest and most varied floras of any region in the United States within reach

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, March 28, 1931.

of a large metropolitan area. And fortunately so, for this abundance of plant life means that unlimited opportunities are thus open to the students of the many schools and colleges around New York, as well as to the city's numerous amateur students of botany.

The Torrey Club, by the way, is the oldest botanical organization in the United States. Named for Professor John Torrey of Columbia University, an eminent American botanist in his day, it was established more than sixty years ago, and has devoted itself since to an extensive study of the flora of New York.

Geographically, this territory covers all of New Jersey, several northeastern counties of Pennsylvania, Long Island, the Hudson Valley as far north as the Catskills and Taconics, and part of the Delaware Valley, in New York State and Connecticut. It includes five fairly distinct types of vegetation, from the salt marsh and sand dunes of the seacoast, through the pitch-pine and oak lands of southern New Jersey and Long Island, the hardwood belt of chestnut, chestnut-oak, and yellow poplar (tulip tree) in the highlands of New Jersey, New York, and Connecticut, mixed in places with considerable hemlock and a little remaining white pine; a little of the more northern belt of birch, beech, maple and hemlock of northern Pennsylvania and central New York, in the Catskill area; and, on the high Catskills, islands of the northern coniferous forest of spruce and fir.

Very little of this region is in its original condition of vegetation, most having been modified by the work of man for agriculture, mining, charcoal-burning, and timber-cutting, as well as for cities, towns, highways, and railroads. The only areas presenting the same aspect as three hundred years ago, when white settlement of the country began, are some dune and marsh areas on the New Jersey and Long Island shores; a few bogs in the highlands of the Hudson and New Jersey, and some high subalpine tracts of red spruce, balsam-fir and yellow-birch, above 3,000 feet in the Catskills.

Another factor which has changed and injured the hardwood belts is the chestnut blight, beginning twenty years ago, which has killed the species everywhere. Since the American chestnut occupied a large percentage of our mixed forest, sometimes as high as 70 per cent of the stand, its destruction has thinned the

woods, left dead tree-trunks, standing and fallen, which are a fire menace, and generally damaged the timber in a manner from which it has not yet recovered and will not for many years.

These changes in the woody vegetation have had important effects on herbaceous plants. With the clearing of the land for timber and charcoal, and the fires that followed, the effect has been to reduce the more interesting and rare herbaceous species. With these artificial changes came the introduction from Europe and other parts of world, by intention or accident, of hundreds of adventive plants, which have become firmly established and thus reduced the areas formerly occupied by purely native species. Some of these adventives were attractive; but most of them were not, compared to the native plants which they displaced, and the result, while increasing the total of species, has, in my opinion, made our vegetation poorer in quality of interest and beauty. But this is past helping; we put quarantines on our plants too late, and these immigrants are now firmly fixed in our plant life.

An earlier factor affecting the distribution of plants in our region was the last great geological event hereabouts, the covering of the northeastern part of the United States with the continental ice sheets of the Pleistocence glacial epoch. The final melting and disappearance of these ice sheets, about 30,000 years ago, opening up the land to the return of vegetation from the south, marked the beginning of the progression of plant life, which resulted in the woody and herbaceous plant cover found here in the seventeenth century, before man and his plant followers changed the conditions and the plant associations.

The development of the conservation idea in recent years and the assemblage of large tracts of semi-wilderness into great public preserves, like the state forests of Pennsylvania, New Jersey, New York, and Connecticut, and the Palisades Interstate Park of New York and New Jersey, has given the original native vegetation a chance to return. Its vigor persists to a degree which is bound to bring it back in some measure as long as such preserves are maintained and extended.

One of the most heartening things for those who regret the disappearance of so many native species before the invasion of imported weeds is the spectacle that may be seen around any of the old abandoned farm sites in the woods, in our highlands.

Native trees, shrubs, and herbs do come back, slowly but inexorably, and smother out the adventive plants established by the old settlers.

Some of the adventive plants we can tolerate and a few accept as desirable additions, where they have not extinguished native species. Immigrants such as the purple loosestrife of the Hudson Valley marshes and streams are sturdy cosmopolites which have followed the migrations of man, and we may admire their pertinacity and courage in finding a hold wherever they can. But we may rejoice that the abandonment of much of the marginal lands mistakenly cleared for farms, and the establishment of public parks and forests, has renewed the opportunities for the original plant inhabitants of our region.

The amateur botanist who has become acquainted with some hundreds of our woody and herbaceous plants, will turn his mind, after learning to identify them, to the causes and peculiarities of their distribution. The persistence of rear guard stands of what are obviously relics from the post glacial migration of species northward into the region uncovered by the melting ice, is one of the most interesting of such botanical phenomena. Such relics are not rare in the New Jersey Pine Barrens, in the higher parts of the New Jersey, Pennsylvania, and New York highlands and in the Catskills and Taconics. The invasions of adventive plants, and their halting where native species have lately gained an advantage through the protection of our forest areas, which enables them to resist or even regain old stands, is another interesting, and to me, a pleasant thing to see. The ap parent continued movement northward of southern species, encouraged by the fact that we are probably still on the swing-back from the last glacial epoch, has given us some curiosities such as the stand of southern bald-cypress on the Hudson River at Anthony's Nose, and the prickly pear cactus as far north as Bear Mountain Park and Constitution Island, opposite West Point.

Our region, it may be seen, lies in the path of the great migration of plants northward after the glacial epoch, and while most of the original vanguard of sub-arctic species has moved north to Hudson's Bay, some of the plants which were in the advance have left isolated stands still with us, and other southern species are evidently moving up in the procession. All such factors—

geological, climatic, artificial—had their part in the present composition of our flora, and will be given their due and relative weight by the thoughtful student in attempting to understand the reasons for the occurrence, distribution, disappearance, persistence, or revival of our local plants.

RAYMOND H. TORREY.

ECOLOGICAL RELATIONS OF PLANT COMMUNITIES[1]

The subject of ecology has to do with organisms as related to their environment. It might, therefore, be characterized as a study of the home influences which act on plants.

Among these influences temperature is one of the most important. This is easily recognized by the common use of such terms as tropical, temperate, and arctic plants. A greenhouse is merely an artificial home for plants which must live in a warm temperature.

Soil moisture is another factor of highest importance. Water passes rapidly through the plant body at an average rate of 300 or 400 pounds for every pound of dry weight produced in the plant. All this water comes from the soil through the roots; therefore, the amount of available water in the soil determines the life or death of the plant. Soil moisture modifies temperature, and as a result we have deserts as well as rain-forests in every climatic zone.

The chemical content of the soil, especially in regard to the amounts of essential minerals present, also strongly influences the growth of plants. The terms "rich" and "poor" soils are simply a rough expression of the amount of available mineral nutrients present in these soils. The presence of acids in certain soils to a certain extent determines which plants can grow in those habitats.

The physical condition of the substratum as to texture and stratification has a certain influence on the growth of plants. Generally speaking, a moderately loose texture is more favorable than a dense one, as it is more easily penetrated by the roots and makes water and mineral nutrients more available.

[1] Abstract of a talk and demonstration given at The New York Botanical Garden on January 10, 1931.

Light is, of course, a very important factor, as it is absolutely essential in making sugar, which is the main food material of plants. Some plants have adapted themselves to using small amounts of light, and so are called " shade-tolerant." Most shade tolerant plants have become so accustomed to the cool moisture of shady homes that they cannot grow in sunny habitats. Exposure to sun, heat, and wind may be regarded as a secondary or indirect factor in the life of plants. Its effect can be recognized easily by comparing the vegetation on both sides of a steep hill or ravine. Considerable difference in the composition of the vegetation will be found in the two extremes.

Other plants and animals also influence plant growth. The chief favorable effect is found in the decay of dead parts, by which essential minerals are returned to the soil. On the other hand, plants, by competition, kill out their less vigorous neighbors. Plants are also responsible for most plant diseases.

Animals affect plants by burrowing and grazing, and also by scattering fruits and seeds.

The home in which any plant grows is a complex of all these factors, and there are many different classes of homes, depending upon the different combinations of factors to be found. Plant species may also be grouped into classes according to their differing requirements, and each type of home will be found to be inhabited by a group of plants having the same requirements. These groups of plants are called plant communities, and each group will be found to be very constant in its choice of a home.

A very marked separation of communities is based on the character of the substratum. A pure sand substratum is found on the dunes, and various sand communities may be differentiated on open, secondary, and fixed dunes. Glacial deposits usually consist largely of glacial clay, mixed with varying amounts of sand and gravel. Here another series of communities may be recognized. Bare rock can support only lichens with mosses and small herbaceous plants in crevices. Humus collects around these colonies, so other communities are characterized by the varying amounts of humus found above the solid rock.

Finally, open water must be regarded as a substratum, as algae and certain floating aquatics are found even in the center of ponds, still other communities in shallow water, and others on the shores.

Another basis for the classification of communities is found in physiographic forms. Upland communities form one group, which are quite different from those of lake and river plains. In ravines, canyons, and on bluffs are other communities, which are generally modifications of the upland communities. Secondary communities are original communities which have been modified by the activities of man, as in the case of a second-growth forest, which follows partial clearing and burning. We also have artificial communities in agriculture and gardening when man prepares the home for the plant species which he wishes to cultivate. Here he is limited by climatic conditions, and to some extent by soil, but he can modify these conditions somewhat and can usually supply as much water as needed. He may even modify light, either by furnishing shade, or using electricity to supplement sunlight.

Another application of ecology of considerable importance is the study of the natural arrangement of vegetation in communities. This gives an exact understanding of what may be called "natural landscaping," and may be used as a basis for naturalistic landscape gardening.

W. G. WATERMAN.

NOTES, NEWS, AND COMMENT

The article on "Forestation with Poplars in France" which was published in the JOURNAL for December, 1930, was reprinted in the April number of "The Oxford Observer," a journal published by The Oxford Paper Company and The Oxford-Miami Paper Company.

Dr. E. D. Merrill, Director-in-Chief, gave an illustrated address on "Plants and Animals of the Philippines and Neighboring Islands—How They Came to be Where They Are" before the Washington Academy of Sciences at the Cosmos Club, Washington, D. C., on the evening of May 21.

Dr. E. D. Merrill was one of the committee of four on selection for the Cuban Fellowships of the John Simon Guggenheim Foundation, which committee made its report about the middle

of May. More than seventy Cubans applied for fellowships. Three fellowships were granted, although only one award had been contemplated. The stipend is usually $2,500, plus a travel allowance.

The New York Botanical Garden has received a silver medal awarded to it for the new hybrid *Hemerocallis* Daylily Mikado, which was exhibited in flower at the International Flower Show held in New York last March. Several plants of this clon were dug from the field late in the autumn of 1930, placed in pots, and held in a greenhouse. Several flowers were thus forced into bloom during the period of the flower show. This new daylily was described and illustrated in *Addisonia* for March, 1930, and in the issue of this JOURNAL for February of this year.

Recent work on the herbarium collections of Algae and Hepaticae include the mounting and filing of 2,226 specimens of algae and 1,076 specimens of Hepaticae from the Rau Herbarium; 1200 specimens of Algae from the Pacific Coast of North America, received by exchange from the University of California; about 1,100 specimens of Blue-green Algae from Porto Rico; 305 specimens of Schiffner's Meeresalgen; 107 sheets of miscellaneous Algae; 100 specimens of Verdoorn's Hepaticae Selectae et Criticae; about 300 specimens of miscellaneous Hepaticae; and about 1200 microscopic mounts of Algae on mica. In addition, 3,500 cards of Tilden's Index Algarum were filed and typewritten copies of the original descriptions of several hundred species of Algae were mounted on herbarium sheets. Duplicate Algae were sent out in exchange to the number of 2,397 specimens. With the aid of temporary assistance provided by the Prosser Emergency Employment Committee, the collections have all been cleaned and dusted.

Meteorology for May. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 64° F. on the 3rd; 73° on the 10th; 86° on the 16th; 78° on the 22nd; and *94° on the 29th.* The minimum temperatures recorded were: *42° on the 5th;* 44° on the 14th; 43° on the 24th and the 25th; and 48° on the 27th. The total precipitation for the month was 4.05 inches.

PUBLICATIONS OF

THE NEW YORK BOTANICAL GARDEN

Journal of The New York Botanical Garden, monthly, containing notes, news, and non-technical articles. Free to members of the Garden. To others, 10 cents a copy; $1.00 a year. Now in its thirty-second volume.

Mycologia, bimonthly, devoted to fungi, including lichens; $5.00 a year; single copies not for sale. [Not offered in exchange.] Now in its twenty-third volume.

Addisonia, quarterly, devoted exclusively to colored plates accompanied by popular descriptions of flowering plants; eight plates in each number, thirty-two in each volume. Subscription price, $10.00 a year. [Not offered in exchange.] Now in its sixteenth volume.

Bulletin of The New York Botanical Garden, containing reports of the Director-in-Chief and other official documents, and technical articles embodying results of investigations. Free to all members of the Garden; to others, $3.00 per volume. Now in its fourteenth volume.

North American Flora. Descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. Planned to be completed in 34 volumes. Roy. 8vo. Each volume to consist of four or more parts. 66 parts now issued. Subscription price, $1.50 per part; a limited number of separate parts will be sold for $2.00 each. [Not offered in exchange.]

Memoirs of The New York Botanical Garden. Price to members of the Garden, vols. I–VI, $1.50 per volume; to others, $3.00. Vol. VII, $2.50 to members; to others, $5.00.

Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Vol. VII. Includes New Myxophyceae from Porto Rico, by N. L. Gardner; The Flower Behavior of Avocados, by A. B. Stout; Descriptions of New Genera and Species of Plants Collected on the Mulford Biological Exploration of the Amazon Valley, 1921–1922, by H. H. Rusby; and The Flora of the Saint Eugene Silts, Kootenay Valley, British Columbia, by Arthur Hollick. viii + 464 pp., with 47 plates, 10 charts, and 11 text-figures. 1927.

Brittonia. A series of botanical papers. Subscription price, $5.00 per volume. Now in its first volume.

Contributions from The New York Botanical Garden. A series of technical papers written by students or members of the staff, and reprinted from journals other than the above. Price, 25 cents each. $5.00 per volume. In the thirteenth volume.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York, N. Y.

GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

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JOURNAL
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"CRAZED" CROCKERY AND OTHER STRANGE HABITATS OF MOULDS[1]

The *Penicillia* and their close relatives are, without a doubt, the most widely known of the lower fungi. The great diversity of their substrata and of the conditions under which they can live, together with their usual attractive green or blue-green color, can account for this fact. They are commonly known merely as the "blue moulds."

Dr. Charles Thom, of the United States Department of Agriculture, has worked for many years on the genera *Penicillium* and *Aspergillus* and includes his findings with those of other investigators in his books "The Aspergilli" and "The Penicillia." The New York Botanical Garden has received from Dr. Thom his collection of 176 *Penicillium* and 52 *Aspergillus* species in living condition. These cultures are being kept viable in our pathology laboratory, and a duplicate set is now on display in cases at the head of the first flight of stairs in the Museum Building. This collection, as well as that of cultures and photographs of fungi pathogenic to man, such as the ones causing ringworm, athlete's foot, thrush and blastomycosis, presented by the Laboratory of Medical Mycology, College of Physicians and Surgeons, Columbia University, has been an object of interest to stu-

[1] Acknowledgment is due Dr. B. O. Dodge for his suggestions and for the enlarged photograph of the *Penicillium* on crockery, and to Dr. Charles Thom for examining the cultures.

dents and others who have visited the Museum during the past three or four months.

Medical men have reported isolations of species of *Penicillium* and *Aspergillus* in connection with a great variety of physical ailments, but little evidence has been presented for their causal relationship. It is quite definitely established, however, that in persons with the particular idiosyncracy, asthma may be produced by certain species, for example, *Penicillium oxalicum.* Evidence also points strongly to the conclusion that some members of the "*Scopulariopsis*" group, formerly thought to be closely related to *Penicillium,* may cause nail infections and certain other superficial skin diseases. Among the *Aspergilli,* some of the black forms have been accused of infecting the human ear, causing otomycosis, although experimental inoculations have not proved their pathogenicity. Other species of *Aspergillus* have been connected with skin and lung troubles.

In view of the prevalence and adaptability of these fungi, it is fortunate that the human system can deal adequately with the infective elements of most of those consumed with food, breathed, or brought into contact with the body.

The literature on the subject often mentions unusual habitats, particularly for species of *Penicillium.* India ink, paste, cork, egg shells, sugar and corn meal are some of these. The housewife frequently finds *Penicillium* colonies growing upon bread, canned fruits, jellies, or on vegetables and fruits sold in the markets. In warm damp climates, she is also annoyed by mildew of fabrics, due to members of the *Penicillium* group.

To the gardener *Penicillium* may become a menace among stored bulbs kept too moist and warm. The *Penicillium* rot of gladiolus corms is frequently complained of by growers. Blue mould of tulip bulbs is another common trouble. Fruits and vegetables stored even for a short time may be attacked by *Penicillia.* Apples and berries in transit and very commonly citrus fruits are rotted by the "blue moulds." Other stored products, such as flour, ensilage, rubber, tobacco, and even paper, have been reported to nourish *Penicillium.* The moisture factor is the most important in storage mould development. Good ventilation and regulated temperature do much to decrease the losses, but anti-

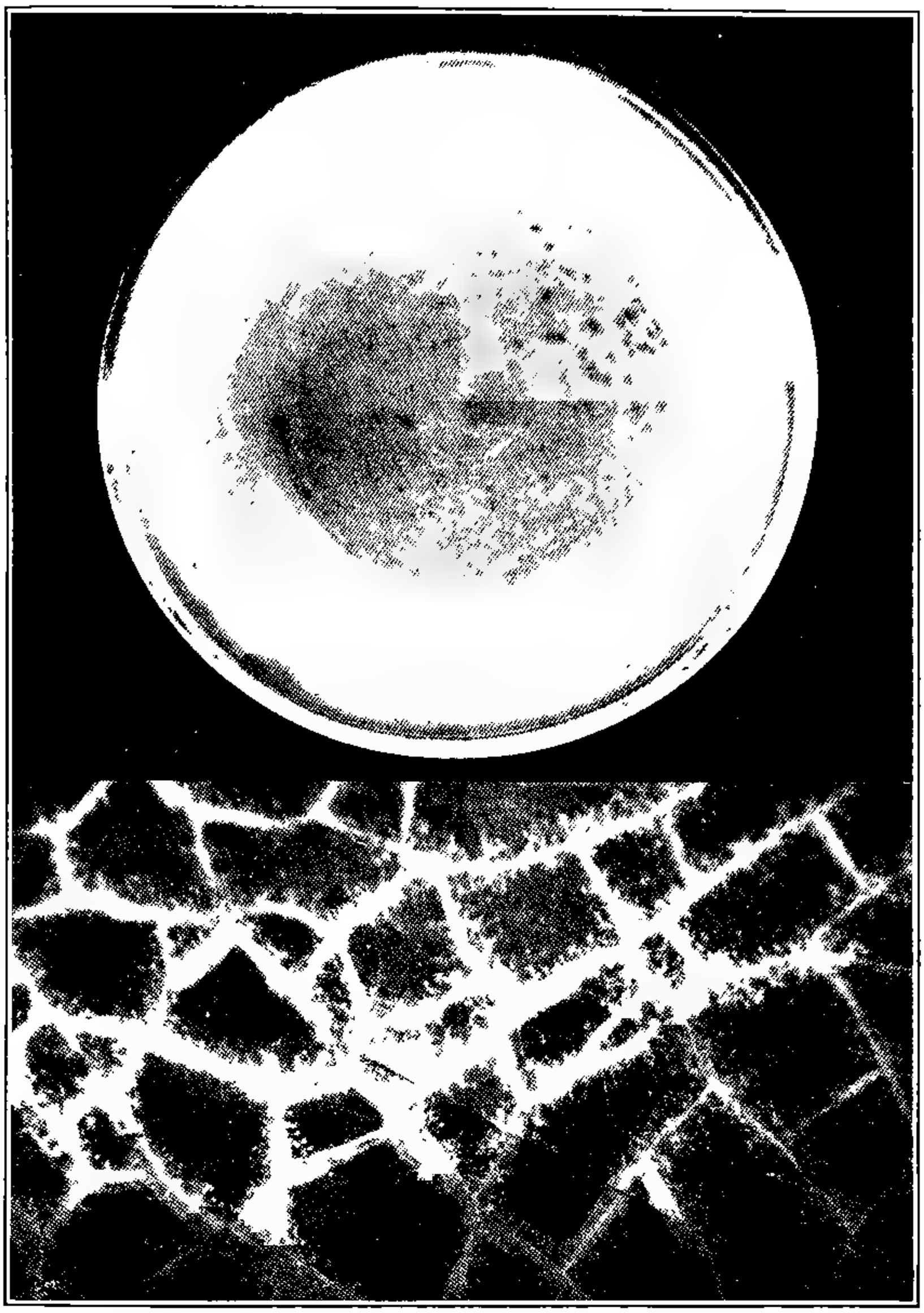

FIGURE 1. The upper photograph shows fungus spots under the glazing of crockery, reduced one half. The lower picture shows the fungus after it had grown considerably on another piece of crockery. Note the ropes of mycelium following the "crazing." The lower figure is enlarged about fifteen diameters.

septics such as weak boric acid or borax solution in the case of fruits are often necessary.

That *Penicillia* are not all annoying is appreciated by the cheese connoisseur who has them to thank for some of his choicest flavors. *Penicillium Camemberti,* a light-colored form, is grown on a commercial scale in northern France so that the spores may be sown on cheese curds. The growing fungus imparts the flavor peculiar to Camembert cheese, and the presence of any contaminating species is quickly detected in the taste of the product. In Roquefort, Gorgonzola, and other blue-veined cheeses, the contributing fungi, *Penicillium Roquefort* and *P. Gorgonzola,* are plainly visible.

The rôle of the *Penicillia* in the soil, from which they have been isolated in large numbers, has not been definitely established. That some of them have the faculty of attacking cellulose has been proved, and their presence may have a significance in soil fertility.

The variety of media on which *Penicillium* can subsist is well known to workers in laboratories, where it is the most common contaminant of cultures. It is also found here in dilute alcohol solutions. Certain aniline tissue stains, some strongly alkaline, others strongly acid, are sometimes found by cytology students to contain *Penicillium.* Other chemicals ordinarily considered fatal to life can support certain species. Even hydrochloric, sulphuric, acetic, lactic and citric acids, copper sulphate, and formaldehyde, in low concentrations, of course, have been found accommodating species of *Penicillium.* Tests to determine a possible antiseptic to be used in foods to prevent mould development have shown that as a rule the *Penicillia* can adjust themselves to greater concentrations of poisonous chemicals than can humans.

Among the various records of unusual substrata for *Penicillia* no mention has been made of one recently observed in the laboratory, namely, painted crockery. At the time of the purchase of these pieces a few inconspicuous bluish spots were noticed on the inside, apparently just under the paint (FIGURE 1), but no further thought was given them until a fungous growth developed. After one of the pieces had been used and washed a few times in hot water it was found, after an interval of a few days,

covered inside and out with a fine dust composed of spores of *Penicillium*. A binocular microscope showed the glazed surface to be "crazed" or "crackled," the fine cracks making a net-like pattern over the dish. The mycelium of the fungus consistently followed the pattern of the checks and formed hollow rope-like strands of rough-walled hyphae just over them, from which extended side branches bearing the typical spore-producing "brooms." The lower photograph in FIGURE 1 shows a piece of the material enlarged about fifteen times to show the manner of growth. What nourishment the fungus might be obtaining from this material can only be surmised, but, as indicated by the figure, growth was luxuriant.

In the May, 1931, number of *The American Home*, an article on the care of the refrigerator warns against the use of cracked or chipped dishes as food containers because they favor bacterial growth. That fungi may also be included in this warning is indicated by the case reported here where pieces of crockery, although not cracked, showed crazing of the surface. This crackling, when not done intentionally for decorative purposes, may occur in the baking of inexpensive earthenware when the glazing and the material beneath respond differently to the heat.

Cultures were easily obtained and the fungus was grown on various agar media. Microscopic measurements and cultural characteristics showed it to be somewhat different from any of the species in the Thom collection. Dr. Thom was good enough to give his opinion on its identity, indicating that it belongs in the "fasciculate" group. A secondary form accompanying one of the cultures was identified by him as close to *Penicillium melegrinum*.

Our attention has been directed to another unrecorded occurrence of a member of this group. A shipment of dried paste of crushed seeds of *Paullinia cupana* from South America, known to natives as Guarana and used commercially as a source of caffein, was found by Professor W. J. Bonisteel, of Fordham University, to be mouldy. He brought a specimen to the laboratory, and isolations from the inner material, with due care being taken to exclude any surface organisms, resulted consistently in a noteworthy *Aspergillus* belonging to the *glaucus* group. The conidia of this fungus are particularly distinctive. Although they vary

considerably in size and form they are always covered with fine warts and show a collar-like "connective" at one or both ends where they were attached to others in a chain. The enlarged figure of a single conidium (FIGURE 2, D) illustrates the most

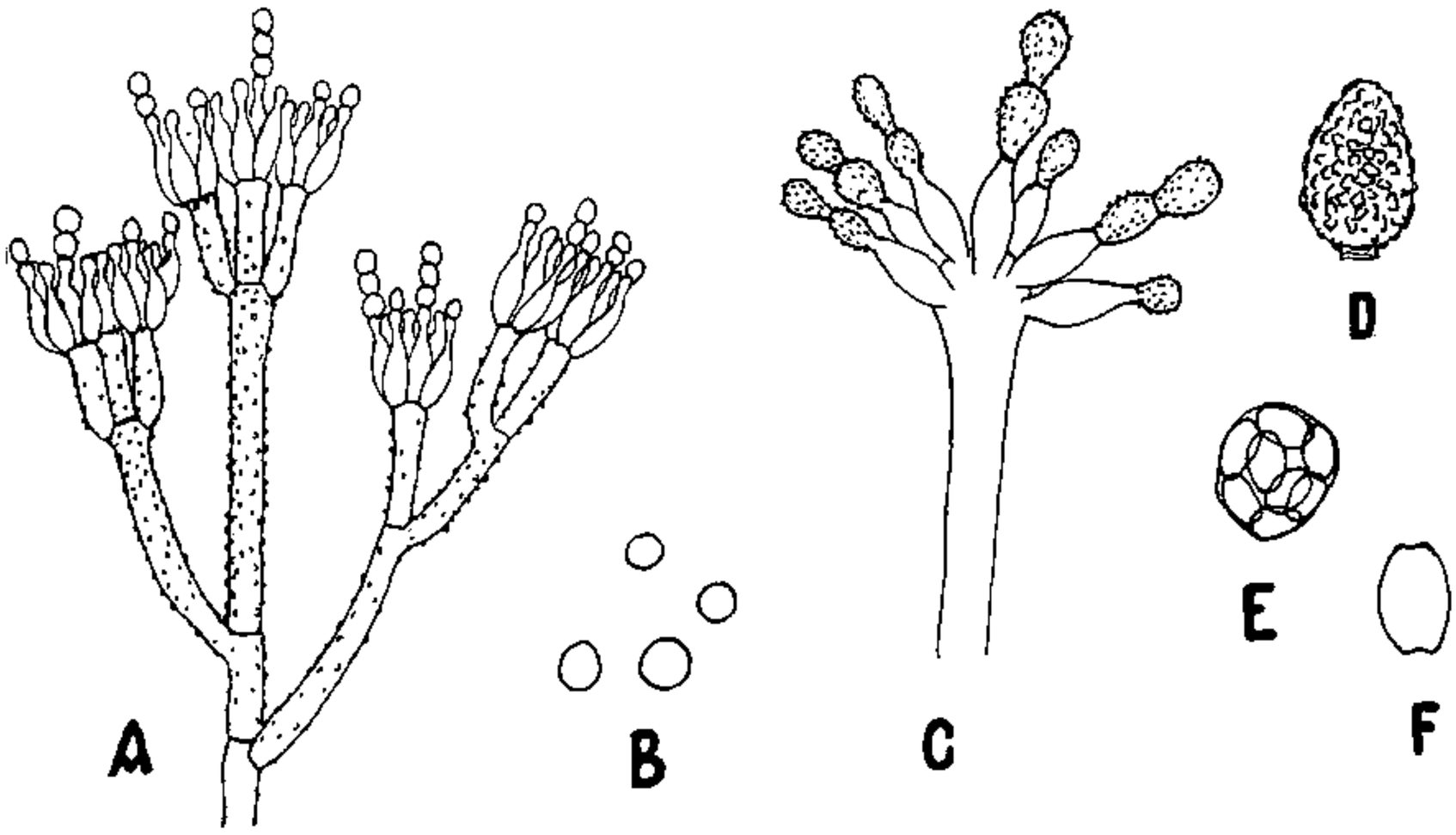

FIGURE 2. A, Spore "brooms" of the crockery *Penicillium*. B, Individual *Penicillium* spores. C, Spore-head of the Guarana *Aspergillus*. D, Individual *Aspergillus* conidium. E, Ascus of the Guarana *Aspergillus* F, Single ascospore. All highly magnified.

common form. The conidial heads are also very variable (FIGURE 2, C). Sometimes they show only a slight enlargement of the vesicle and so take on the appearance of a *Penicillium* fructification. Some send out numerous long branches from which secondary heads develop. Yellow ascocarps with smooth ascospores form in about five days on Czapek's agar (FIGURE 2, F). Dr. Thom points out in a letter to the writer that the measurements of these spores are similar to those of *Aspergillus repens*, but differences in the form of the ascospore and particularly in the type of the conidium distinguish it from that species. Possibly it should be considered a variety or strain of *A. repens*.

Reports have been made of the occurrence of an *Aspergillus* belonging to the *A. glaucus* group in paste of cacao beans, which may be a situation analagous to the present report. It was indicated that the *Aspergillus* in that case can tolerate very low moisture content and hence becomes a problem for shippers.

MARJORIE E. SWIFT.

BARTRAM'S IXIA COELESTINA REDISCOVERED

"What a beautiful display of vegetation is here before me! Seemingly unlimited in extent and variety: how the dew-drops twinkle and play upon the sight, trembling on the tips of the lucid, green Savanna, sparkling as the gem that flames on the turban of the eastern prince. See the pearly tears rolling off the buds of the expanding Granadilla; behold the azure fields of cerulean Ixea! what can equal the rich golden flowers of the Canna lutea, which ornament the banks of yon serpentine rivulet, meandering over the meadows; the almost endless varieties of the gay Phlox, that enamel of the swelling green banks, associated with the purple Verbena corymbosa, Viola, pearly Gnaphalium, and silvery Perdicium."[1]

These lines of a favorite form of eighteenth century English well describe some of the plants and their environment in northern Florida. The phrase mentioning *Ixia* is here the most interesting reference.

The middle of the first week of June (1931) found Professor and Mrs. Lord of the University of Florida at The New York Botanical Garden after a two days' trip from Gainesville, Florida.

During an inspection of Miss Eaton's illustrations of some iridaceous plants of our Gulf States, upon sighting a recently finished painting of a species of *Nemastylis* from Louisiana, Professor Lord said, "That plant grows in the flatwoods north of Gainesville, Florida." Our rejoinder was to the effect that perhaps it was this plant or perhaps it was something different. This expression of doubt resulted in an invitation to drive back to Florida with them the beginning of the following week and see the plant for myself. The invitation was accepted, and it resulted in the botanical rediscovery of Bartram's *Ixia coelestina,* in flower, in spite of the fact that the plant had already been in flower for several weeks.

En route, at Fayetteville, North Carolina, we were met by H. A. Rankin, who has furnished the Garden with a number of rare and new plants in recent years. Here we were well on William Bartram's trail, so to speak. Mr. Rankin, in a letter recently received, states:

[1] Bartram, Travels through North and South Carolina, Georgia, East and West Florida. 153. 1791. (Philadelphia edition.)

Returning homeward from one of his trips to Florida and other Gulf States, Bartram passed through what is now Fayetteville. On reaching North Carolina he stopped at Lake Waccamaw. Thence he went across country to the old Wilmington-Fayetteville road, and stopped at "Ashwood" the home of Colonel William Bartram, his uncle, for whom he was named. "Ashwood" is now owned by a descendant of Colonel William Bartram, at one time a schoolmate of mine. After leaving "Ashwood," Bartram mentions a creek forty miles distant. This distance puts us at Willis Creek fifteen miles south of Fayetteville. Along this creek may be seen the ruins of old sawmills and petrified tree-trunks which Bartram mentions in his "Travels." Next he mentions Rockfish Creek which you crossed about seven miles south of Fayetteville, but not on the old road. After this his itinerary brought him to Cross Creeks, 'another very considerable branch of the river [North West]. This creek gave name to a fine inland trading town.' The town of Cross Creeks was subsequently to become the flourishing town of Cambleton, named in honor of Sir Farquand Cambell of revolutionary prominence in the region, and a grandfather, several times removed, of Mrs. Rankin.

Bartram mentions many shrubs and trees he found growing in that region. These still may be seen where he found them or nearby.

Seven o'clock in the evening of June ninth found us near Starke, Florida, at one of the localities marked for the plant sought. Partly ripe pods were abundant among the grass, but no flowers could be found in the flatwood. Knowing something of the habits of iridaceous plants we were not discouraged. Returning early the following morning, we were rewarded by the sight of fields of flowers, which, however, gave only a faint idea of what were the beauty of these areas of flatwoods at the height of the flowering season, as indicated by the very numerous ripening capsules. These were so numerous that Bartram's statement about "azure fields of cerulian Ixea" seems perfectly justifiable. The very noticeable early withering of the flowers interested us greatly. It indicated either an exceptionally short diurnal period, or the end of a longer, perhaps mainly nocturnal period of activity. Of course, the color (lavender-violet) of the corolla seemed to argue against the second alternative.

FIGURE 1 (on opposite page). William Bartram's illustration of *Ixia coelestina* published in his "Travels" (plate 3 of the Philadelphia edition) —a very good representation of this rare and interesting iridaceous plant.

IXEA CÆLESTINA.

Rad. bulbosa subrotunda. Caulis *teres, vaginatus* Foliis *linearilanciolatis, cuspidatis.* Floribus *expansis magnis cæruleis.*

vid. Tourn.

Direct observation being the only way of solving this problem, we decided to let the plant answer for itself, and started for the field the next morning before dawn. The flowers had not been open during the night, so the second alternative was eliminated. As the sun rose the swelling buds burst! After about three hours the perianth showed signs of withering, and by about nine o'clock the daily routine was at an end.

The next question that suggested itself was, what is the daily routine of this plant in the flowering season? Each plant consists of a bulb which supports a leaf and a flower-stem (scape). Rarely the scape has a lateral branch. The scape, and its branch when present, terminates in a simple or compound spathe from which arises a flower, or in case of a compound spathe a second flower which opens the day after the first flower is spent. After the flower withers in the forenoon, the plant ceases apparent activity. Up to sundown no flower, not even a bud appears for the following day. Through the night the bud develops, apparently very slowly at first, and it is not until sunrise that the perianth is visible and ready to burst.

Having assumed that our observations would be completed by seven o'clock, we had arranged to meet Professor Hume of the University of Florida over at the St. Johns River at eight o'clock in order to see stations for this plant which Professor Hume had noticed a short time before. These were readily found, but the place where the plant had grown most abundantly is now a vast cultivated field. Thus the native flora is gradually eliminated! Bartram's original station appears to have been somewhere near Lake George. Our observations in that region were made too late in the forenoon to verify this supposition.

Early in the past century Thomas Nuttall referred to Bartram's *Ixia coelestina* as, "A very scarce plant, and a doubtful genus, . . ."[2]

A reference to this plant by William Barton follows:

"The venerable William Bartram, who is still living at Kingsess Gardens, mentions in his travels into Florida that he met with whole fields of the *Ixia coelestina*. The visits of late botanists not having thrown his plant in their way, led some to doubt

[2] The Genera of North American Plants. *22*. 1818.

whether Mr. Bartram had really met with an Ixia, or whether he had not mistaken some other plant for it. Mr. Nuttall, however, has corroborated the account of Mr. Bartram, by meeting with two or three species of Ixia, one of which is here figured. This circumstance has afforded great gratification to the venerable naturalist, whose plant however appears to have been another species of the same genus. The figure he has given of it in his travels, besides having larger flowers, differs from this in the ovate-obtuse petals, as well as in the shape and size of the anthers and filaments. When I commenced the drawing of the plant in the presence of Mr. Bartram, he was of opinion that the flowering plant was the same he had seen and figured. A little more attention to the characters to which I attracted his attention, however, convinced him it was a different species. Not seeing good reason to separate the genus from Ixia, as Mr. Nuttall has hinted the propriety of doing, in his travels, the figure of this rare and new plant is here presented to botanists as a second species of the *Ixia coelestina* of Bartram, and I have designated it by the specific appellation acuta, to distinguish it from that plant, the petals of which, as has already been mentioned, are very obtuse."[3]

This humble and individually unassuming plant has been "driven from pillar to post" since its discovery over a hundred and fifty years ago. Truly, for a plant quite unknown or nearly unknown in the body, it has had an exceedingly variable career.

The discoverer, in 1791, assigned it to the genus *Ixia,* a group of plants really confined to Africa. Thomas Nuttall, in 1833, confidently assigned it to his new genus *Nemastylis,* although curiously enough, it totally lacked the diagnostic characters of that genus. Nuttall also vitiated its geography by assigning it to Arkansas and South Carolina, leaving Florida, where it was discovered, out of its range. Later in the nineteenth century the plant also masqueraded under such genera as *Marica* and *Beatonia,* thus drifting further and further from its true botanical position.

Although often and for a long time associated with the genus *Nemastylis* in a rather careless way, the flower of this plant is quite distinct from that of *Nemastylis* and from those of any other known genus. The flower of *Nemastylis* is erect, strictly actinomorphic, the corolla lying in a horizontal plane, the thread-

[3] A Flora of North America 2: 90–91. 1822.

like style-branches and stigmas protruding at right-angles to the style and beneath the anthers, the erect anthers in shedding the pollen dropping it on the stigmas beneath. All is different in the Bartram plant, as far as the flower is concerned. The flower is nodding and somewhat zygomorphic, being held at the tip of the scape in a perpendicular position; the stamens project perpendicularly to the corolla, but the compound style, a curious clavate-

FIGURE 2. A group of *Salpingostylis coelestina* in flatwoods north of Starke, Florida. The perianth is violet or lavender-violet. The flowers are sometimes called violets by the natives. The plants grow most abundantly in a middle-ground, on the slope from the drier high parts to the wetter areas about cypress-heads.

cornucopia or trumpet-shaped structure, with reniform stigmas attached to the ovary by very slender threads, is soon pulled below the stamens and receives the pollen as it is shed from the anthers above it. The shedding of the pollen is greatly facilitated and accelerated by a host of hopping insects which inhabit the flatwoods where the plant grows. Other minor differences also exist.

After "sailing under false colors" for over a hundred and fifty years, having been confidently placed in one genus, transferred to another, and so on, with perfectly good diagnostic characters recorded on a plate at the very beginning of its career, this plant

has, it is to be hoped, found a secure haven in the binominal **Salpingostylis coelestina** (*Ixia coelestina* Bartram).[4]

The history of this plant will illustrate the several methods of taxonomic botany—field botany, closet-botany, long-range botany, etc. The dicoverer and observer of the plant in question, in publishing the species used nineteen words—seven in the text and twelve on the plate. His method was field-botany or exploration. Subsequent botanists who confidently wrote pages on this plant never saw specimens alive or in herbaria. They got their results through the methods of closet-botany or long-range botany and every one of them was in error!

Coincident with the solution of the status of the Bartram plant, the existence of a new species of *Nemastylis,* a genus typical of the Louisiana, Texas, Oklahoma, Arkansas region, native in Florida, was established. The long-known species of *Nemastylis* are spring-flowering plants. All evidence at hand indicates that the Florida species is fall-flowering. It is hoped that opportunity to study this plant in the field will be forthcoming this fall.

JOHN K. SMALL.

THE RELATION OF CIVILIZATION TO BIRDS AND THEIR FOODS[1]

Civilization would be impossible without birds. Every living plant has hosts of insect enemies. In spite of all the developments of modern science, using sprays, insecticides, and even poison powder and poison gas, we are forced to admit a national loss—due to obnoxious insects—every season, of at least $1,000,000,000. It would be utterly useless to continue the warfare with-

[4] **Salpingostylis** Small, gen. nov. Perennial scapose herbs with bulbs. Leaf basal, narrow, plaited. Scape erect, simple or rarely branched. Spathe narrow, the bracts acuminate. Flowers solitary in a spathe or two together, perfect, nodding. Perianth slightly zygomorphic, with the sepals slightly larger, and broader at the base than the petals. Stamens 3, erect, with the anthers straight or nearly so, with a very narrow connective. Styles united to near the top into a trumpet-like structure with a very slender base and soon declined. Stigmas reniform, spreading, double-toothed. Capsule erect, obovoid.

[1] Abstract of a talk given by Mr. Paul B. Mann, of Evander Childs High School, on May 16, 1931, at The New York Botanical Garden.

out the assistance of our feathered friends, who are the natural enemies of insects and whose help in this particular cause becomes of the greatest significance.

If insects chew up all the leaves of a plant—no matter how sturdy the root system, eventually the plant will die, because the leaves are the food factory of the plant. In their green cells, starch, sugar, and proteins are formed, which in turn become the basic food of the world of animals and humans.

More than seventy-five kinds of obnoxious insects have been imported into this country, and only two birds, neither of which can be classed as a truly beneficial. It is our native birds that keep these insect pests in check.

Not only do birds eat harmful insects: they destroy vast quan tities of weed seeds. Sparrows are the most valuable.

The birds of prey, the hawks and owls, are also beneficial, for the most part, because they feed not only on injurious insects but particularly on field mice and other rodents.

Civilization also owes a great deal to birds from the aesthetic standpoint. We know better than to kill them to put on hats, as was the custom prior to 1914. Appreciative of their appeal in song and color, regardful of their direct benefit to mankind through their food habits, we are beginning to insist upon real conservation of our wild birds. "Sanctuary" is the slogan of the campaign.

PAUL B. MANN.

THREE RECENT BOOKS ON PLANT GEOGRAPHY

Dr. Rübel set himself a gigantic task in attempting to bring to gether in one volume a general discussion of all the manifold types of vegetation of the world.[1] He brought to it an unusually wide personal experience derived from his travels in many lands and an equally thorough knowledge of the literature. The result is a handsome and authoritative volume which must be as great a satisfaction to its author as it is a delight to its readers.

[1] Rübel, Eduard. Pflanzengesellschaften der Erde. Pp. viii + 464. 242 *f.* + map. Hans Huber, Bern and Berlin. 1930. Fr. 37.50.

After a few pages devoted to a general statement of the principles underlying the differentiation of plant associations and a review of some of the various systems of classifying them, he proceeds to state his own system, which groups associations into twenty-seven classes arranged in nine larger divisions. These are based on the form, structure, and habits of the plants themselves as correlated with the environment in which they live. Each of them is then discussed in turn, with indication of their geographic distribution, general physiognomy, and climatic correlations, and handsomely illustrated from photographs. The last are indeed a feature of the book, coming from all parts of the world and portraying practically every type of vegetation. The work closes with a map of the vegetation of the world, on a scale of 1 to 90,000,000 and in ten colors. We may hope that a translation of the book into English will soon follow.

* * * *

Dr. Rübel is also the editor and one of the contributors to another volume[2] presenting the botanical results of the fifth international phytogeographic excursion through Czecho-Slovakia and Poland in 1928. Dr. Rübel gives an account of the activities of the excursion and eight of the participants present in detail some of its scientific results.

* * * *

Mount Kilimanjaro is the highest known mountain in Africa, its twin craters, perpetually covered with snow, rising to a height of nearly twenty thousand feet. Dr. Geilinger has recently ascended the peak and given an account of his experiences and of the vegetation in a very readable and interesting book.[3] The feature which will appeal especially to botanists is his description of the remarkable vegetation which is luxuriantly developed at high altitudes, including forests of podocarps, thickets of dragon trees, and great candelabra-like plants of *Lobelia* and *Senecio*. The excellent half-tones illustrate these and other plants pro-

[2] Ergebnisse der Internationalen Pflanzengeographischen Excursion durch die Tschechoslowakei und Polen 1928. Pp. 328. 25 *f.* Hans Huber, Bern and Berlin. 1930. Fr. 16.50.

[3] Geilinger, Walter. Der Kilimandjaro, sein Land und seine Menschen. Pp. 182. 156 *f.*+4 col. pl. and map. Hans Huber, Bern and Berlin. No date [1931].

fusely, give many interesting glimpses of the natives and the larger mammals, and show landscapes and other features of the country all the way from sea-level to the peak of the mountain.

H. A. GLEASON.

PUBLIC LECTURES AT THE GARDEN

During the remainder of the summer, the following free public lectures will be given at The New York Botanical Garden. The lectures, illustrated by lantern slides and otherwise, are given in the Museum Building on Saturday afternoons at four o'clock.

July 18. "Diatoms, Microscopic Beauties," Dr. Marshall A. Howe, Assistant Director.
July 25. "Edible and Poisonous Mushrooms," Dr. Fred J. Seaver, Curator.
Aug. 1. "Coal, Its Origin and Development," Dr. Arthur Hollick, Paleobotanist.
Aug. 8. "New Gladiolus Varieties," Dr. Forman T. McLean, Supervisor of Public Education.
Aug. 15. "Collecting Fungi in Northern Wisconsin Woods," Dr. B. O. Dodge, Plant Pathologist.
Aug. 22. "Seedless Fruits," Professor F. A. Varrelman, American University of Washington, D. C.
Aug. 29. "Through the Mountains of Colorado, Wyoming and South Dakota," Dr. Fred J. Seaver, Curator.

The program of lectures given during the spring and early part of the summer consisted of the following:

Mar. 7. "Rock Gardening without a Rockery," Mrs. Wheeler H. Peckham, Honorary Curator of Iris and Narcissus Collections.
Mar. 14. "Begonias as House Plants," Mrs. H. H. Buxton, Corresponding Secretary, National Council of State Garden Federations.
Mar. 21. "Seeds for the Garden," Dr. A. B. Stout, Director of Laboratories.

Mar. 28. "Local Plant Life around New York as Studied by the Torrey Botanical Club," Mr. Raymond H. Torrey, Torrey Botanical Club.

April 4. "British Guiana," Dr. H. A. Gleason, Curator.

April 11. "Wild Gladioli and Their Tame Cousins," Dr. Forman T. McLean, Supervisor of Public Education.

April 18. "Aquatic Plants," Dr. John Hendley Barnhart, Bibliographer.

April 25. "Big Trees and Redwoods of California and Their Preservation," Dr. Elmer D. Merrill, Director-in-Chief.

May 2. "Floral and Scenic Features of Cuba," Dr. Marshall A. Howe, Assistant Director.

May 9. "Spring Flowers," Dr. Kenneth R. Boynton, Head Gardener.

May 16. "The Relation of Civilization to Birds and Their Foods," Mr. Paul B. Mann, Evander Childs High School.

May 23. "Fungi in Their Human Relations," Dr. J. Gardner Hopkins, Professor of Dermatology, College of Physicians and Surgeons, Columbia University, and Dr. B. O. Dodge, Plant Pathologist, New York Botanical Garden.

June 6. "John Bartram, American Quaker and Botanist to the King," Dr. John Hendley Barnhart, Bibliographer.

June 13. "Rice, the Greatest Food Plant in the World," Dr. H. A. Gleason, Curator.

June 20. "Vegetation of the Philippines," Dr. Elmer D. Merrill, Director-in-Chief.

June 27. " Roses," Mr. Kenneth R. Boynton, Head Gardener.

July 11. "Daylilies," Dr. A. B. Stout, Director of Laboratories.

A GLANCE AT CURRENT LITERATURE[1]

Among the "Garden Implements That Save the Back" described in *Horticulture* for June 15, 1931, are a rubber-toothed rake, a four-purpose cultivator that stirs the surface soil, pulls out weeds, protects overhanging branches, and serves when desired as a wheel-plough; also several hoses with special nozzles and sprays, wire stakes with a spiral loop to hold up plants, and garden curbings of steel and zinc.

* * * *

"The Gardener Takes to the Water" is the title of an article by R. W. Lindsley in *Nature Magazine* for July, well illustrated with plans and photographs of an attractive lawn pool which the author built. Easily understood directions are given for the construction, care, and planting of the pool, the total cost of building which was under $25.

* * * *

Successful garden ferns are pictured and described in the *American Fern Journal* for April–June, 1931. The species mentioned, which include *Woodwardia areolata, Pellaea atropurpurea,* and *Asplenium Ruta-muraria,* are all growing in the New Jersey garden of W. Herbert Dole.

* * * *

New England wild flowers which can add an attractive corner to one's garden are treated in the current leaflet of the Lexington Botanical Garden at Lexington, Mass. Marsh-marigolds, trillium, bunchberry, columbine, violets, iris, butterfly-weed, lilies, harebell, cardinal flower, rose mallow, and gentian are the principal ones mentioned.

* * * *

Of interest to those who like to go botanizing along the coast is a pamphlet just received on "The Origin and Development of the Vegetation of Sandy Hook," by M. A. Chrysler of Rutgers University. It is a reprint from the *Bulletin of the Torrey Botanical Club* for December, 1930.

[1] All publications mentioned here—and many others—are available in the library of The New York Botanical Garden, in the Museum Building.

Also from Mr. Chrysler's pen, in the form of a reprint from *Science* of February 20, comes a report of a new fossil cycad found near Woodbridge, N. J.

* * * *

Bush-honeysuckles and their value to gardeners are discussed in the *Arnold Arboretum Bulletin of Popular Information* for June 18. J. G. Jack, the author, gives important points in the selection and propagation of these plants.

* * * *

Although compiled for the region within fifty miles of Milwaukee, the new vest-pocket edition of the mushroom guide published by the Milwaukee Public Museum should be practical for any area of similar climate and soil. It contains a key to the species, a glossary, illustrations, an index, and recipes for cooking the edible varieties. Huron H. Smith is the author.

* * * *

Some "fossils in the making"—if such they can be called—have recently come to light along the shore of New Jersey, it is reported by Horace G. Richards in *Science* for June 19, 1931. Where heavy seas have washed away the sand, sod bearing horses' hoof-prints has been revealed. Stumps of trees and roots of many plants have also been found in the layer of sod that has been hidden for years beneath the beach-sands.

* * * *

In a study of inheritance and chromosome number in the gladiolus, appearing in *Torreya* for May–June, 1931, Dr. Forman T. McLean of The New York Botanical Garden points out that with 14 chromosomes in each pollen grain and egg cell of this flower, there is a possibility of 4,792,869 different types of seedlings arising in the second generation from the crossing of two species. The following generation, if two interspecific hybrids are crossed, may have 100,000,000,000,000 possibilities of type.

* * * *

The Ginkgo tree, native of China and Japan, which has been widely introduced in New York as an ornamental, is interestingly described by George Weideman Groff in the October, 1930, *Lingnan Science Journal,* a scientific organ of Lingnan University, Canton, China.

Native names for this tree, which has great paleobotanical importance, are the Grandfather-grandson or the Silver Almond tree or the White Fruit Pine. Quoting E. Watson,[1] Dr. Graff says:

"In China white nuts are used as food and are usually found on the table at wedding feasts, for which occasions the shell is commonly dyed red. The Chinese credit white nuts with a great many medicinal properties, and use them in treating coughs, asthma, bladder and uterine complaints, etc. When eaten raw, white nuts are said to destroy cancer; when cooked they are considered to be peptic and anthelmintic. The Japanese use white nuts to promote digestion. In addition to being used in food and medicine, white nuts are sometimes used to wash clothes and, when digested in wine or oil, in making a kind of detergent cosmetic."

"On account of sentimental attachments," continues the author, this time quoting W. Y. Chun,[2] "the tree is not often cut down. . The wood is soft, but straight-grained, light brownish in color with a silky sheen. . . The Japanese use the leaves for fertilizer, especially on rice fields under water. They ascribe to the leaves an insecticidal power."

CAROL H. WOODWARD.

NOTES, NEWS, AND COMMENT

Dr. E. D. Merrill, Director-in-Chief, has recently been elected to membership in the Washington Academy of Sciences.

Dr. Fred J. Seaver, Curator, spent several days recently in Philadelphia looking over types of fungi in the Schweinitz collection. Wherever possible, microscopic slides showing spore characters were prepared with the permission of Dr. Francis W. Pennell, and brought back to The New York Botanical Garden for critical study. These were later incorporated in the herbarium of The New York Botanical Garden.

[2] The Principal Articles of Chinese Commerce. 1923.

[3] Economic Trees of China. 1923.

Drs. Merrill, Barnhart, and Hollick represented The New York Botanical Garden at the celebration held in Philadelphia June 5 and 6 to commemorate the scientific achievements of John Bartram on the two hundredth anniversary of his founding of the first Botanic Garden in the American Colonies. Dr. Barnhart presented a paper on the "Significance of John Bartram's Work to Botanical and Horticultural Knowledge."

The Narcissus, Iris, Peony, Rock Garden, and Rose exhibits at The New York Botanical Garden have been unusually attractive this year, due to favorable climatic conditions, replantings of iris, treatment of diseased plants, and notable additions of newer peony varieties. All of these floral displays have attracted numerous visitors and have received much favorable comment and publicity. To make use of stock on hand and to release space in the limited propagating grounds, naturalistic plantings of daylilies and native iris have been initiated in the north meadows, under the supervision of Mrs. Wheeler H. Peckham and Mrs. Harold McL. Turner.

The Garden's iris exploration and studies were continued in the Gulf States during April and part of May this year by Dr. John K. Small and Mr. E. J. Alexander. Most of the time was devoted to the field of native iris in the lower Mississippi River Delta and in the Pearl River Delta. Both sides of the Mississippi River and bayous, swamps, and marshes, mainly between the Mississippi and the Atchafalaya rivers, were explored. Some work was done west of the Atchafalaya River as far as the Côte Blanche Region and Jeanerette. Several thousand specimens of iris plants were sent in for the Garden plantations and for minor plantations in different parts of the United States.

Recent visitors to the library included the following botanists: Mr. Rimo Bacigalupi, Gray Herbarium, Cambridge, Mass.; Prof. Alexander W. Evans, New Haven, Conn.; Prof. Wm. Mansfield and Miss Elsie G. Whitney, Albany, N. Y.; Prof. H. H. Whetzel, Miss Harriet B. Creighton, and Mr. S. H. Burnham, Ithaca, N. Y.; Prof. George L. Zundell, State College, Pa.; Prof. Edgar T. Wherry and Dr. F. W. Pennell, Philadelphia, Pa.; Prof. F. D.

Fromme, Morgantown, W Va.; Dr. Walter Swingle, Prof. A. S. Hitchcock, Prof. Charles S. Parker, Mr. John A. Stevenson, and Mr. E. P. Killip, Washington, D. C.; Prof. Wm. Trelease, Urbana, Ill.; Dr. D. T. MacDougal, Tucson, Ariz.; Prof. F. E. Lloyd, Toronto, Canada; Prof. Marie Victorin, Montreal, Canada; Dr. Winifred E. Brenchley, Rothamsted Experiment Station, England; Mr. Matsuta Matsubara, Tokyo, Japan; and Prof. Wm. E. Hoffmann, Lingnan University, Canton, China.

A popular account of the "Diseases of Lilies" by Professor Carl E. F Guterman has recently been published in the Year Book of the Horticultural Society of New York for 1930. This report summarizes all the available information regarding diseases of lilies known to be present in the United States, including the results of the research done under the Lily Disease Investigation Scholarship established in 1927 under the coöperation of Cornell University, The Boyce Thompson Institute for Plant Research, The Horticultural Society of New York, and The New York Botanical Garden. Dr. Guterman has accepted a position as Assistant Professor in Plant Pathology in Cornell University but the research on lily diseases is being continued by Mr. K. O. O'Leary, a graduate of the University of Washington and a research student at Cornell University. Mr. O'Leary is spending a part of his time at The New York Botanical Garden in the effort to eliminate the virus diseases from the display plantings of lilies.

The Fifth International Botanical Congress, held in Cambridge, England, in August, 1930, authorized the publication of an International Address Book of Botanists and appointed a committee of three to compile and edit the book, this committee consisting of Prof. Dr. L. Diels, Director of the Botanical Garden and Museum at Berlin-Dahlem, Dr. E. D. Merrill, Director-in-Chief of The New York Botanical Garden, and Dr. T. F. Chipp, Assistant Director of the Royal Botanic Gardens at Kew. The last publication of this kind is the third edition of Dörfler's Botaniker-Adressbuch, which appeared in 1909 and is now badly out of date. The committee, therefore, has had to collect all the information anew. The arrangement will be by countries alphabetically, and a

general personal index will make possible the easy tracing of any individual botanist. In addition to the names and addresses of botantists, the names of all institutions wholly or in part botanical will be included, as well as all botanical societies. The book is being published by Messrs. Baillière, Tindall and Cox, Henrietta Street, Covent Garden, London, and will be sold in the United States and Canada for $3.25. The low price has been made possible by a loan from the Bentham Trustees of London and a grant from the Carnegie Corporation of New York, the latter having been secured through the directorate of The New York Botanical Garden.

The famous Bull Creek and Dyerville forests, held to be the supreme development of California's giant redwoods, are now assured of preservation as a part of California's state park system. The Save-the-Redwoods League has announced that it has secured sufficient contributions and pledges to match state park bond funds for the acquisition of these lands. Many public spirited individuals and organizations throughout the United States have contributed. John D. Rockefeller, Jr., by a gift of $1,000,000 and a pledge of a second million to match private gifts as received, made possible the success of the project. Organizations such as The Garden Club of America, The California Federation of Women's Clubs, and the Native Daughters of the Golden West contributed substantial funds. The new acquisition comprises more than 13,000 acres, valued at more than $3,500,000. With the previously acquired Humboldt State Redwood Park, the total acreage preserved in that region is now approximately 16,000 acres. Thus successfully culminates a major item in the ten-year campaign of the Save-the-Redwoods League, under the presidency of Dr. John C. Merriam of the Carnegie Institution of Washington. Besides Mr. Rockefeller, other New Yorkers who have been influential in carrying through this project are Dr. Henry Fairfield Osborn of The American Museum of Natural History, Mr. Madison Grant of The New York Zoölogical Society, and Dr. E. D. Merrill of The New York Botanical Garden, all members of the Council of the Save-the-Redwoods League.

The Metropolitan Gladiolus Society, of which Dr. Forman T. McLean, Supervisor of Public Education, is President, is staging a midsummer show, particularly featuring the Gladiolus, on August 25 and 26, in the Grand Central Palace, at Lexington Avenue and 47th Street. Mrs. Franklin D. Roosevelt, Mrs. John W. Draper, Mrs. Robert Bacon, Mrs. Wheeler H. Peckham, Mr. Henry de Forest, and Mr. William H. Webster are among the patronesses and patrons. The preliminary announcement under the title "Plant Gladiolus" was sent out the last of March, and the final prize schedule, listing more than two hundred classes, with prizes and medals for all seasonable flowers, was distributed by mail the second week in July. All of the members of the Garden and their friends are most cordially invited both to exhibit at and to attend the show. The entries are open to all, whether they are members of the Society or not. The New York Botanical Garden has just finished planting nearly 15,000 Gladiolus corms, comprising nearly 1500 different varieties, plantings being all timed with the aim to have them in bloom for the show. The Garden is anticipating to exhibit more than 1000 varieties at that one time. With entries from amateurs, novices, commercial growers, and from the nearby private estates, this exhibit can easily display the finest assortment of Gladiolus and late summer flowers ever placed in any one exhibition. Any one wishing a copy of the final prize schedule may secure one by writing either to The New York Botanical Garden or to the Show Manager, Mr. E. A. Teven, 480 Lexington Avenue, New York, N. Y.

Meteorology for June. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 89° on the 5th; 84° on the 12th; *100° on the 20th;* 95° on the 27th; and 96° on the 28th. The minimum temperatures recorded were: *51° on the 2nd;* 54° on the 10th; 59° on the 18th; and 57° on the 24th. The total precipitation for the month was 3.56 inches.

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GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 41,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ————.

Conditional bequests may be made with income payable to donor or any designated beneficiary during his or her lifetime.

All requests for further information should be sent to

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JOURNAL
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THE NEW YORK BOTANICAL GARDEN

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SALVAGING THE NATIVE AMERICAN IRISES
JOHN K. SMALL

RECENT SCIENTIFIC OBSERVATIONS IN PORTO RICO
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A GLANCE AT CURRENT LITERATURE
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FISH-POISON PLANTS MAY PRODUCE IDEAL INSECTICIDE

PUBLIC LECTURES DURING SEPTEMBER, OCTOBER, AND NOVEMBER.

NOTES, NEWS, AND COMMENT

ACCESSIONS

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FRED J. SEAVER, PH. D. ..... *Curator*
ARTHUR HOLLICK, PH. D. ..... *Paleobotanist*
BERNARD O. DODGE, PH. D. ..... *Plant Pathologist*
FORMAN T. MCLEAN, M. F., PH. D. ..... *Supervisor of Public Education*
JOHN HENDLEY BARNHART, A. M., M. D. ..... *Bibliographer*
PERCY WILSON ..... *Associate Curator*
PALMYRE DE C. MITCHELL ..... *Associate Curator*
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MARY E. EATON ..... *Artist*
ROBERT S. WILLIAMS ..... *Administrative Assistant*
E. J. ALEXANDER ..... *Assistant Curator*
ALBERT C. SMITH, A. B. ..... *Assistant Curator*
CLYDE CHANDLER, A. M. ..... *Technical Assistant*
MARJORIE E. SWIFT, A. M. ..... *Assistant Pathologist*
ROSALIE WEIKERT ..... *Technical Assistant*
KENNETH R. BOYNTON, B. S. ..... *Head Gardener*
G. L. WITTROCK, A. M. ..... *Docent*
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ROBERT HAGELSTEIN ..... *Honorary Curator of Myxomycetes*
E. B. SOUTHWICK, PH. D. ..... *Custodian of Herbaceous Grounds*
ETHEL ANSON S. PECKHAM. *Honorary Curator, Iris and Narcissus Collections*
JOHN R. BRINLEY, C. E. ..... *Landscape Engineer*
WALTER S. GROESBECK ..... *Clerk and Accountant*
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IN MEMORIAM: ROBERT W. DE FOREST, EDWARD D. ADAMS, AND MORTIMER L. SCHIFF

At a regular meeting of the Board of Managers of The New York Botanical Garden, held on June 19, 1931, the following minutes and resolutions in regard to the life and services of the recently deceased managers, Robert W. de Forest, Edward D. Adams, and Mortimer L. Schiff were adopted:

ROBERT W. DE FOREST

Robert W. de Forest died on May 6, 1931, a few days after completing his eighty-third year. He was a member of the Board of Managers of The New York Botanical Garden since 1904, and since 1906 had been one of the most active members of its Executive Committee.

A wise and far-sighted counselor in important affairs, he had a distinguished career as a lawyer and as a director of business enterprises. From his early manhood until almost the day of his death he gave liberally of his time and thoughts to the interests of the City of New York, where he was born and lived during his long life.

He thought out his plans and understood the difference between what was essential and what unessential to their fulfilment and was thus able to adapt them to the views of others. He knew how to compromise without sacrificing the end he had in view.

He had vision, courage, caution, patience, persistence, as well as far-sighted practical wisdom.

The outcome of his work as an organizer and director of cultural and philanthropic institutions carried on by private enter-

prise and in coöperation with the City Government, as well as his part in extending the activities of the City Government itself toward the improvement of living conditions and the beautifying of the City, entitle him to be placed among the very first of New York's citizens who have really led in City affairs.

He was peculiarly qualified to serve The New York Botanical Garden because of his keen interest in nature. He was a lover of trees and flowers. He gave the Garden untiring devotion and his tact and considerateness in dealing with its affairs during the many years he was a member of its Board of Managers made his influence dominant in its councils.

Resolved, That the Managers of The New York Botanical Garden hereby express their great appreciation of the distinguished services rendered to The New York Botanical Garden by Robert W. de Forest, their satisfaction in having had the benefit of his wise counsel for so many years, and their deep regret in the loss of an esteemed friend and associate.

Resolved, That the foregoing preamble and resolution be entered on the minutes and that a copy be transmitted to Mr. de Forest's family, with our warmest sympathy.

Edward D. Adams

We, the Board of Managers of The New York Botanical Garden, desire to join in the universal expression of regard called forth by the death of Mr. Edward D. Adams, at his home in New York City, on May 20, 1931.

As philanthropist and patron of the arts and sciences, Mr. Adams gave unstintingly of his time and ability to the service of the public. Prominently identified with many institutions, Mr. Adams served as a valued member of this Board from 1912 until the time of his death. All through his association with The New York Botanical Garden, Mr. Adams showed a marked interest in its affairs, being a generous contributor to its endowments, a former Vice-president of the institution, and member of various committees.

Resolved, That the Managers record their profound sorrow caused by the death of Mr. Edward D. Adams and express to his family their appreciation of the service rendered by him, as well as their admiration for his mental powers, which so singularly distinguished him in many fields of human endeavor.

Mortimer L. Schiff

It is with the deepest regret and sorrow that we have to record the sudden death of Mr. Mortimer L. Schiff at his home at Oyster Bay, Long Island, on June 4, 1931.

Mr. Schiff had been a member of the Board of Managers of this institution since 1926 and a member of the Corporation since 1909.

The extent of his philanthropies covered a wide field of charitable and social service activities expressed not only by gifts but in terms of actual time contributed from a busy life.

Of the highest ideals and integrity, he held the unqualified respect of all, making his loss keenly felt, but leaving a standard for all who came in contact with him.

Resolved, That these resolutions be spread upon the minutes and a copy sent to Mr. Schiff's family, with our warmest sympathy.

SALVAGING THE NATIVE AMERICAN IRISES

Iris is ancient and iris is modern. It appealed to the ancients in the abstract, interpreted by the imagination through the poetry of the early Greek theology. To the moderns its appeal became concrete through their sciences. In the varied significances of the word, iris has been an object of study, exercising the mind of man from the dim past.

The first-named Iris was the daughter of Thaumas and the ocean nymph Electra. Personified by the rainbow, whose base is on earth and apex in the skies, she thus became the messenger of the gods. After ages of mystery the physicist established the true status of the rainbow, thus connecting the fancies with the facts and still connecting the terrestrial and celestial regions.

Today Iris has come down to earth and is best known as a group of plants quite universally distributed around the Northern Hemisphere. The assigning of the mythological name Iris by Linnaeus to the plants in question was far more appropriate than this botanist ever dreamed, for its flowers appear in a chromatic scale of color much broader than he realized. At present Iris has become a scientific problem for the botanist, the geneticist, and the plant geographer, and an esthetic adjunct for the horticulturist and the plant breeder.

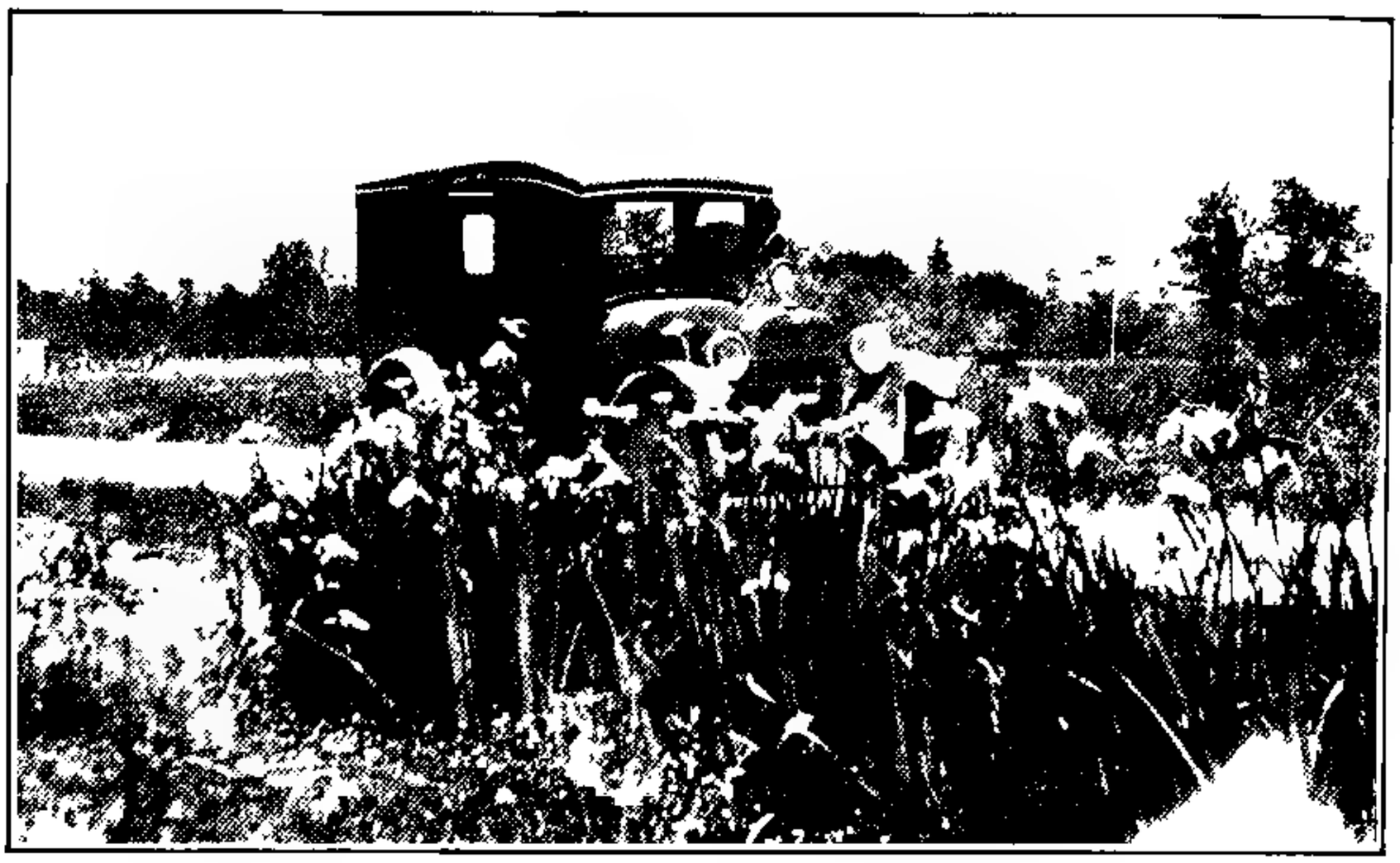

FIGURE 1. In the delta of the Pearl River, Louisiana. A small patch of *Iris giganticaerulea* in the foreground. The "weed-wagon" (the popular name for our collecting motor) in the background. The above-named species and myriad forms of *Iris virginica* constitute the iris flora of the Pearl River Delta.

THE IRISES OF LOUISIANA

To The New York Botanical Garden, at least as an institution, belongs the credit of rescuing for the botanist and the horticulturist the remnants of the wreckage of the most wonderful natural iris field yet discovered.

Strange as it may seem, what was the maximum development in this iris field of the lower Mississippi River Delta, even in recent modern times, will never be known.[1]

To one who has seen the southern Louisiana irises in flower in the Garden's plantations or who has seen only the paintings of the flowers, the words wreckage and remnants may not adequately convey the true state of affairs to his imagination. Only by a thorough study in the field can one either picture to himself the present conditions or imagine those of the recent past.

Whatever devastation nature may have been responsible for in recent geologic time we have no means of knowing, except as indicated on a following page; but the discouraging things that have

[1] This opportunity of rescuing iris plants and ascertaining facts through exploration has been made possible through the interest of several friends of the Garden.

FIGURE 2. Collecting iris in swamp at Arabi, Louisiana. Colonies large and small of many kinds of iris occur here. This swamp and those of Gentilly are the richest in various kinds of iris.

happened in the past and are happening in the present are well known from direct and indirect evidence.

After a thorough survey of the iris lands in the New Orleans region, we confidently calculate that through rural improvements and urban growth about eighty per cent of the iris fields of a half century ago have been ravaged or destroyed!

Consider the bottom-lands and the adjacent marshes in the New Orleans region south of Lake Ponchartrain. The bottom-lands are the more elevated and are cut by bayous (creeks) of various sizes and depths. The edges and vicinity of the bayous are the favorite haunts of the native irises. The plants have also invaded the marshlands, which are the lower areas lying between the bottom-lands and the Gulf of Mexico, and often develop into vast colonies there, but these areas are subject to overflow by salt water blown landward by violent storms, so that their iris development has not maintained as sure a hold as it has on the bottom-lands. Thus the marshlands and the bottom-lands, comprising the two geologic formations south of Lake Ponchartrain, once held this iris development complete.

In the case of the marshlands, nature may destroy and may rebuild the iris fields. On the other hand, on the bottom-lands against man's destructive methods, nature has little chance to restore any vegetation that has been eliminated. In the urban or metropolitan regions the iris growth that once inhabited marshes, swamps, and bayous has as a rule been utterly wiped out, except in suburban sections where much may remain in spite of drainage, filling of low places, and the erection of buildings.

In the rural parts of the region under consideration the same agencies of destruction operate in a minor way. Where the large agencies of devastation are (I) lumbering, (II) agriculture, and (III) the dredging of bayous so as to make them into water-highways, these agencies are thoroughly destructive. The first two speak for themselves. In the case of the third it may be explained that the bayous, whose sloping banks were once vast iris gardens continuous for many miles, are made into canals by dredging and piling the excavated materials on the banks, even to the extent of making levees. The iris growth is thus exterminated, except for an occasional iris plant which may have escaped by being thrown on top of the excavated materials and which, surviving, starts a small colony of that species. This colony may continue for a time, but when the materials of the banks are removed for one purpose or another, even this remnant of the once vast iris garden succumbs. Furthermore, a highway is usually made just back of the bayou banks, and homes and settlements spring up along the highway. Vegetable gardens, sugar-cane plantations, and general agriculture drive out the remnants of the native irises. In order to show how thorough these destructive agencies may become, take the Bayou Lafourche for example. This stream is now a federal water-highway and its banks on both sides of the stream are lined with houses and settlements for a hundred miles.

American Iris in Botany and Horticulture

Within the past two years many kinds of native iris have come to our attention. They have been brought into the fold of botany and are being introduced into horticulture.[2]

[2] In these notes only the eastern American irises are considered. The western American ones, as a result of the remoteness of many of their natural habitats, have in the past and are now suffering less devastation and extermination.

FIGURE 3. Our shortest-stemmed iris—*Iris flexicaulis*. In the typical form of this iris the flower-stalk is about six inches long. It is zigzag and frequently lies on the ground. This iris is related to *Iris foliosa*, in which both leaves and flower-stalks lie on the ground.

Up to the beginning of this century our native irises received relatively little attention from either botanists or horticulturists. The active and well-known American Iris Society devoted its attention and resources almost exclusively to the natural irises of the Old World or to their numerous hybrids.

References to American iris first appeared in European plant literature late in the seventeenth century. A period covering two centuries, less about a score of years, comprises the technical botanical history of American iris. A period longer by about half a century covers the horticultural history.

The history of the irises under consideration falls naturally into three epochs. The first begins with the botanical introduction of the three species, *Iris versicolor*,[3] *Iris virginica*,[4] and *Iris verna*[5] by Linnaeus. This first epoch covers a period of nearly 150 years. In this period, in addition to the three Linnaean species, eight others were published by six authors, both in America and in Europe.[6] Curiously enough, up to this time, the beginning of the present century, there were generally recognized ten or eleven species of Iris in eastern North America and the same number in western North America.[7] The same group of iris is not represented in both regions. None of the plants of western North America reaches the large stature of those of the eastern.

The beginning of the second epoch may be dated 1902, when *Iris foliosa*[8] was published by Mackenzie and Bush. Twenty-six

[3] *Iris versicolor* L. Sp. Pl. 39. 1753; various plant provinces, eastern North America.

[4] *Iris virginica* L. Sp. Pl. 39. 1753; various plant provinces, southeastern United States.

[5] *Iris verna* L. Sp. Pl. 39. 1753; various plant provinces, southeastern United States.

[6] See Journ. N. Y. Bot. Gard. **31**: 41–42. 1930.

[7] A list of those now known west of the Rocky Mountains, as interpreted by botanical writers of the regions involved, comprises the following:

Iris bracteata S. Wats. Proc. Am. Acad. **20**: 375. 1885.
Iris californica Leicht. Garden **52**: 120. 1897.
Iris Douglasiana Herb.; Hook. & Arn. Bot. Beech. Voy. 395. 1841.
Iris Hartwegi Baker. Gard. Chron. II. **5**: 323. 1876.
Iris longipetala Herb.; Hook. & Arn. Bot. Beech. Voy. 395. 1841.
Iris macrosiphon Torr. Pacif. R. R. Rep. **4**: 144. 1857.
Iris missouriensis Nutt. Jour. Acad. Phila. I. **7**: 58. 1834.
Iris Purdyi Eastwood. Proc. Calif. Acad. Sci. III. Bot. **1**: 78. *pl. 7 f. 2.* 1897.
Iris setosa Pall.; Led. Fl. Ross. **4**: 96. 1852.
Iris tenax Dougl.; Lindl. Bot. Reg. **15**: *pl. 1218.* 1829.
Iris tenuis S. Wats Proc. Am. Acad. **17**: 380. 1882.

[8] *Iris foliosa* Mackenzie & Bush. Trans. Acad. St. Louis, **12**: 81. 1902; Coastal Plain and adjacent plant provinces in the Mississippi River Valley.

FIGURE 4. Our tallest-stemmed iris—*Iris giganticaerulea,* growing in a swamp near Cut-Off, Louisiana. In this swamp violet-flowered irises prevailed. The plants were mostly three to five feet tall. The plants in the colony shown above were fully seven feet tall. If some of the drooping leaves were straightened up they would overtop one's head.

years was the time extent of this second epoch, during which six species, additional to *Iris foliosa,* brought to light by exploration in the Gulf States were published by the writer.[9]

Observation during explorations in the lower Mississippi River Delta indicated a third and very spectacular epoch, ushered in by the publication by the writer of seven species, one from peninsular Florida and six from southern Louisiana.[10]

Up to 1929 our explorations and studies of these lower Mississippi Delta irises was of necessity somewhat desultory. After that date the unusual displays of native irises in southern Louisiana led us to concentrate on the region and to make the best of the opportunities at our disposal.

The Range of Color of the Iris

Mr. Alexander, co student with the writer, of these Louisiana irises, records that it is interesting that the great range of color mentioned is more apparent than real. Among the many shades represented, none goes into true red and none into true blue. The nearest approaches to red in the numerous *Iris fulva* variations always have a cast of orange; the nearest approaches to blue always have a cast of violet or purple; and the "red" and the "pinks" in the group *Roseanthae* are really not red or pink at all, but various shades of lilac, red-lilac, red-purple, red-violet, pink-lilac, and rosy-lilac. All of these, with one or two exceptions, are represented within a certain few pages of the color dictionary[11] when laid out for actual color-matching.

A possible clue to the origin of some of the species in the lower Mississippi Delta region lies in the fact that when *Iris fulva* is growing somewhere nearby, irises other than "blues" are likely to be found. This seemingly indicates that this peculiar "red" iris may have had a large part in the production of such a really startling scale of colors as our recent explorations have brought to light. It also indicates that many of the now fixed and geographically well established species other than the *Iris giganticaerulea* types were possibly of hybrid origin.

[9] See Jour. N. Y. Bot Gard. 31: 43. 1930.

[10] See Jour. N. Y. Bot. Gard 31: 44 1930.

[11] A Dictionary of Color. By A. Maerz and M Rae Paul. McGraw-Hill Book Company, Inc, New York, 1930.

The two possible parental species, so to speak, *Iris fulva,* "red," and *Iris giganticaerulea,* "blue," have proved themselves to be champions of variation in color-tones. Up to two years ago these two plants were considered quite simple in coloration. Our recent explorations have shown them to hold color-values almost beyond belief.

(I) The primitive guardian of the "red" possibilities (*Iris fulva*) exhibits in its flower a range of colors from clear yellow (albino) through various shades of orange and red-orange to lavender-pinks, and from orange-crimson to mauve and dull-violet; in addition one form, a rich, clear, dark violet may possibly be a form of *Iris fulva* also. Thus the entire scale of known colors for iris, with the exception of the "blue" shades, would be embraced in the iris formerly considered rather drab!

(II) The primitive guardian of the "blue" possibilities (*Iris giganticaerulea*) is sometimes colorless, or white (albino), and exhibits all the shades of blue and violet to purple and lilac. Both species occur in purple, lilac, lavender, and mauve. It is thus possible that these two species, as ancestral forms running the complete color-gamut, are the parent forms and all the other species in the geographic range occupied by the two were produced by their natural hybridization. This theory would account for the absence of the spectacular Delta irises from the regions between where they now grow and where they or their ancestors must have come from. The trail of *Iris fulva* still leads back to the higher elevations. *Iris giganticaerulea,* however, does not give as complete a history of its ancient migration.

A native yellow iris was unknown in America up to a few years ago (1929). A native yellow iris is still rare and much sought for in the vicinity where it has been found. At present, four different yellow irises have been found in southern Louisiana: (I) a canary-yellow form of *Iris fulva* collected independently by George Thomas and the writer; (II) a light creamy-yellow, an albino of *Iris vinicolor* found by Ethel Anson S. Peckham; (III) a light, dull, creamy-yellow of uncertain relationship found by Edward J. Alexander; (IV) a pale creamy-yellow of uncertain relationship found by the writer.

Color is not the only variety shown by Louisiana irises.. There is much variation in the size of plants. Mentioning the extremes,

the flower-stalk of *Iris flexicaulis* may be six inches high; while that of *I. giganticaerulea* may be seven feet high. (FIGURES 3, 4.)

COLLECTING IRIS IN THE SOUTH

The weather in southern Louisiana last winter was spring-like up to March. Then it turned cold for a month. This drop in temperature retarded the growth of the iris plants to such an ex tent that they did not flower until two or three weeks later than usual. As soon as the normal spring weather prevailed, the iris fields burst into color. From this time to the end of the flowering season we devoted every day—and long days to field-work, collecting plants to ship to the Garden and recording the colors of the various parts of the flowers of all kinds not studied the previous year. The field-work of last spring was participated in by Ethel Anson S. Peckham, Rachel L. Lowe, Edward J. Alexander, and the undersigned. A large share of our success was due to the keen eye and the skill of John B. De Winkeler, as mechanic and driver. Our mileage from start to finish amounted to about 6,500. The citizens of New Orleans interested in iris facilitated our work in many ways. In collecting from large colonies we naturally leave plenty of plants for future growth, and in the case of small colonies we take such material as we need for study and leave enough to continue the natural growth and ultimate increase. Dr. D. T. Macdougal, of the Scientific Directors of the Garden, *en route* from Tucson to New York, spent a day in the field with us. Especial thanks are due Mr. George Thomas, Superintendent of the Parking Commission of New Orleans, for furnishing facilities for assembling and packing.

Although we could not cover all the ground mapped out in our original plans, by using all the time and facilities at our disposal we were able to send to the Garden for growing about 6,000 iris plants from more than 450 colonies. Our activities were confined to parts of the broad Delta peninsula south of the latitude of Lake Ponchartrain lying between the longitude of the Pearl River Delta on the east and the Côte Blanche region on the west.

In this way, in spite of the probability of continued devastation in the course of urban progress, at least some of the irises of this region have been insured of preservation. However, every effort will be made to continue the exploration and preservation of this as yet unexhausted store of the American Iris.

JOHN K. SMALL.

RECENT SCIENTIFIC OBSERVATIONS IN PORTO RICO

In continuation of former studies, and as chairman of the committee of The New York Academy of Sciences charged with the Scientific Survey of Porto Rico and the Virgin Islands, I spent, with Mrs. Britton, the period from December 8, 1930, to April 23, 1931, in Porto Rico, occupied with various details of this Survey, and its relationships to insular science and education. Administrative coöperation was cordially given by Governor Theodore Roosevelt, Hon. Carlos E. Chardon, Chancellor of the University; Hon. Edmondo Colón, Secretary of Agriculture, and Hon. Jaime Bagué, Assistant Secretary, and we are grateful for their advice and for much information.

Much of our time and attention was given to geology and palaeontology, owing to the important discovery, during the winter, by Mr. James Thorp, of the Soil Survey of Porto Rico, in progress by the United States Department of Agriculture, in coöperation with the Insular Government, of several localities rich in large fossils, in strata of the Older Series of rocks, whence none, but those of microscopic organisms, had hitherto been obtained. The fossils were found for the most part in quarries opened and worked during the past few years for road-material and in rock-cuttings made during the construction of new roads; they include the remains of corals, of mollusks, and of other invertebrate animals, and were obtained in the San Juan, Arecibo, and Coamo-Guayama districts as mapped by geologists of the Scientific Survey. Mr. Thorp obligingly guided us to the localities, and was of much assistance, with Mrs. Thorp and Señor Jorge Landrón, in collecting many specimens. After correspondence with Professor Charles P. Berkey, of Columbia University, representing geology on the New York Academy of Sciences Committee, it was deemed desirable that the localities should be studied by Professor Howard A. Meyerhoff, of Smith College, Northampton, Massachusetts, who had just completed the geology of the Fajardo District,[1] and who is now occupied in writing the geology of the Arecibo District. At my invitation, Professor Meyerhoff came

[1] Sci. Surv. Porto Rico & Virgin Islands 2: Part 3, with geological map. 1931.

on March 23rd and made geological studies until April 2nd; during this period large additional collections were secured, again with help from Mr. Thorp, and both series of specimens were shipped to Professor Meyerhoff for critical study, with coöperation from Professors J. J. Galloway and H. N. Coryell, of Columbia University. The field work and shipping were greatly aided on several occasions by Don David Noble; and Don Ramón Gandía Córdova accompanied us on one of the collecting trips. We added to the collections two unique specimens of an organism obtained by Mrs. Britton from a limestone quarry near Aibonito, found by workmen, and set aside for us, beautifully preserved, of an unknown species. Supplementary collections of fossils were made in April, 1931, by Captain John R. Embeck, U. S. A., guided by Don David Noble.

The total number of different species represented, obtained from ten localities, is not fewer than twenty, a notable contribution to West Indian palaeontology; their critical study should go far toward determining the actual geological age of the older rocks of Porto Rico, a question which has long been debated, with the preponderance of opinion favoring the Cretaceous Epoch, but with insufficient palaeontological information.[2] Among these species, one found in abundance in metamorphosed limestones near Cialitos, and again near the Jueyes River Water Gap east of Coamo Springs is a peculiar and conspicuous organism, forming cylinders a foot long or longer and about six inches in diameter; cross-sections show narrow, radiating, necklace-like bands, giving them a wheel-like aspect. This fossil was first made known from the older limestone of the island St. Croix, by John T. Quin, who described and illustrated it in his interesting account of the geology of that island,[3] but without giving it a name, or reaching a definite conclusion as to the biological affinity of the organism. Along the Cialitos River and elsewhere in the Cialitos Limestone we saw cliffs and slabs containing hundreds of these fossils, which will provide wonderful museum specimens. The identity of the old limestones of Porto Rico and St. Croix, the uplifts of the two islands separated by about

[2] See Meyerhoff, Geology of the Fajardo District, Sci. Survey 2: 219–229, 1931, and preceding reports by other geologists.

[3] The building of an island, 4to, pp. 106. Christiansted, St. Croix. 1907.

forty miles of Caribbean Sea, is of surpassing geological interest and importance.

With Professor Meyerhoff, studies were made of the stratigraphy of the Older Series of rocks at many places, especially as distorted by folding and the numerous intrusions of molten rock, after the sedimentation of the strata and their partial or complete solidification into conglomerates, shales and tuffs of inorganic, largely volcanic origin, and limestones formed in deeper water, through the accumulation of microscopic organisms and their débris; the complexity of structure thus produced is very baffling; at points where unconformability of strata has been supposed to occur, it may well be that the apparent abrupt change in character of the rocks, was due to rapid changes in the depth of water in which the sediments were deposited. The distortions are especially evident in some of the limestones.

Progress of the Soil Survey was followed with high appreciation of the value of this investigation to agricultural problems and to its geological relationships.

We continued botanical and horticultural observations, and collected many specimens. The Supplement to the Descriptive Flora of Porto Rico and the Virgin Islands[4] was published in December, 1930. During our recent studies a few unrecorded wild species were detected, noteworthy among them the vine like shrub *Stegnosperma halimifolia* Benth., first found by Professor Charles E. Horne on a steep wooded slope southwest of Aibonito, and hitherto known only from Santo Domingo, Cuba, Jamaica, western Mexico, and Central America, and an attractive little orchid, with bright yellow flowers in long clusters, a *Pleurothallis,* related to a Jamaican species, found by Mr. James Thorp growing on a cliff near Adjuntas. Numerous additional lichens were collected, which, when studied, may add species to those already known from Porto Rico. Additional notes and records were made of exotic plants introduced by the Agricultural Experiment Stations and by the Forest Service, and the growth or failure of many kinds previously introduced were observed.

Much attention was given to the large collection of water-color paintings of wild Porto Rican plants, made by Mrs. Charles E. Horne during the past ten years, now including over four hun-

[4] Scientific Survey **6**: Part 4, with index to volumes **5** and **6**.

dred species. Suggestion which has been made, that these be published by the University of Porto Rico, where her husband is Professor of Mathematics, seemed to us very desirable of accomplishment, and, after discussion, it was approved by the recently elected Chancellor of the University, Hon. Carlos E. Chardon, and by the Board of Trustees, provided that sufficient funds be obtained to warrant the expense. I offered to contribute text for such publication, and a provisional prospectus has been prepared, for wide distribution, inviting subscriptions. Arrangements were also made for translation of the English text into Spanish, by Mr. Rafael Andrés Toro.

The progress of reforestation through the distribution of many thousand young trees from the nurseries of the Forest Service was observed with interest and appreciation; the work has been well established by Mr. William P. Kramer, Forester, and his assistants, and its recent extension to the Virgin Islands, through shipments of seedlings to St. Thomas, under an arrangement with the Virgin Island government, begins a long needed re-establishment of woodlands there, where the soil and climate are similar to those of the drier parts of Porto Rico. The planting in the Virgin Islands was placed, by the Forest Service, in charge of Mr. William R. Barbour, who initiated the work on St. Thomas and who now succeeds Mr. Kramer, in Porto Rico, owing to Mr. Kramer's transferral to the Pisgah Forest in North Carolina. Many dendrological problems were discussed with Messrs. Kramer and Barbour, as well as with Mr. Arthur S. Fairchild, of Louisenhoj, St. Thomas, who has done pioneer work in the experimental introduction of many plants on his estate there.

The long-continued deforestation of Porto Rico, brought about by the requirements of land for crops and for wood, has reduced its natural areas to a very small percentage; there remain, however, some places of great beauty, very desirable for permanent preservation. I discussed these conditions with many persons interested, and called public attention to the subject in a statement which was published by Don Ramón Gandía Córdova in the February, 1931, issue of his *Revista de Obras Publicas de Puerto Rico*, entitled "Characteristic Natural Features of Puerto Rico demanding Preservation." Natural features of Porto Rico were delightfully discussed, during December, with Professor John C.

VanDyke, of Rutgers College, New Brunswick, New Jersey, who was obtaining first-hand information for another of his well-known volumes on nature in relation to man, and who proceeded to the Virgin Islands and the Lesser Antilles for continuation of his observations. Efforts of a committee of the Women's Civic Club of Porto Rico, under the chairmanship of Mrs. Tower, to beautify city streets and plazas by planting additional trees, and thus to provide more shade, as well as to improve the care of city trees, and prevent their mutilation, were highly appreciated, and we observed progress in this work, and tried to increase its popularity.

Many private gardens were studied, and we are grateful for hospitality and for information. That of Mrs. Heylman at Casa María, on a hill-top at San Germán, is a series of terraces, recently built and planted, where a large collection has already been brought together; the trees on this estate, both wild and planted, are to be labelled botanically for the information of visitors. Mrs. Maxwell's famous *Hibiscus* garden at Ensenada has been enlarged and the number of kinds grown increased; it continues to be an educational illustration of horticultural accomplishments, through irrigation, at sea-level, in a very dry and hot climate. The garden of Mrs. McKay-Jones, at Hacienda Limón, above Villalba, at about 1800 feet elevation, with high rainfall, and cool nights, contains a great variety of herbaceous plants, including many native of temperate regions, importantly informational as regards horticulture in West Indian mountains; we observed here luxuriant growth and abundant flowering of the succulent *Byrnesia Weinbergii,* of the Stonecrop Family, very desirable for tropical gardens, and of interest because its native home is unknown. Here, also, a large area of temperate-zone food-vegetables and fruits is under cultivation, contributing to the need of diversification of the food supply of Porto Rico, demonstrated as practicable here and also at other points at middle and higher elevations. Interesting plants were also studied in the garden of the Misses Noble at Condado, where the rare *Calophyllum* tree previously observed and recorded has made luxuriant growth, fruiting abundantly, and from it seedlings have been obtained by the Forest Service for distribution; this beautiful evergreen tree with large, lustrous leaves and attractive white flowers is a good addi-

tion to species desirable for ornamental planting. At Mrs. Corcoran's estate, near La Muda, the fine sandal-wood tree, previously recorded, had made luxuriant growth, demonstrating the availability of this elegant, small tree for decorative arboriculture. The elegant display of Bougainvilleas in variety, in the garden of Mr. & Mrs. Tower, at Trinitaria, near Pueblo Viejo, as well as many other well-grown, unusual, ornamental plants, were observed there with pleasure and appreciation. The garden of Captain Caprivali at Monteflores contains many species of both native and exotic plants, and some of the latter category have not yet been recorded as introduced into Porto Rico; one of the most elegant is the large-flowered Aguacero (*Brunfelsia undulata*) native of Jamaica, with fragrant, white flowers six inches long, white in the morning, fading yellow in the afternoon, much larger than those of the otherwise similar native kind which is commonly planted.

Studies were also made in the extensive commercial nurseries at Sabana Llana, managed by Mr. F. M. Pennock, where the increasing demand for cacti from all over the world has led to the collecting and shipment of many native Porto Rican plants; a recent development of horticulture was seen in large collections of native air-plants, epiphytes, for shipment. We aided in attaching botanical names.

Scientific work of the Federal Agricultural Experiment Station at Mayagüez, under the direction of Mr. T. B. McClelland, and of the Insular Experiment Station at Rio Piedras, directed by Mr. R. Fernandez García, was of much interest. At the Mayagüez Station we saw a large and striking plantation of several species of *Crotalaria*, very important plants for use in increasing the nitrogen contents of soils, under observation for determining which species is most effective; here, also, further studies were made of rare exotic trees in the arboretum. At the Rio Piedras Station, studies were made in the herbarium, in charge of Dr. Mel T. Cook, and we contributed many specimens toward increasing the reference value of this already important collection; genetical work with papayas (*Carica Papaya*) the well-known, valuable, tropical food-fruit, carried on by Doctor Thomas Bregger, look toward improvement of cultivated races.

Scientific work at the University of Porto Rico was observed with pleasure and gratification. Chancellor Chardon outlined to us plans for a University Museum building, to be built as a unit of the equipment at Rio Piedras. A museum, satisfactorily constructed and installed has always been a need of Porto Rico, and there are important collections available for one there, both under public and under private ownership; many specimens collected during the progress of the Scientific Survey may be incorporated, and many more may readily be collected; instructive exhibits may thus be made promptly, whenever the building and museum cases are completed. Praiseworthy arrangements were made by Chancellor Chardon to commence the teaching of geology at the University and also at the College of Agriculture, by securing the services of Professor Meyerhoff, on sabbatical leave from Smith College, for the University year beginning next autumn; geological instruction here has long been desired; the soils of Porto Rico have all been derived from the disintegration of the rocks and are the basis of agriculture; and geology is widely recognized as an important element in liberal education.

We made field excursions with the staff of the Biological Department of the University, headed by Professor García and Mrs. Rachel Dexter, and helped in the collection and determination of specimens for class-work. One of these trips, to the eastern mainland of Porto Rico was kindly aided by Don Jorge Bird, Manager of the Fajardo Sugar Company, who put the motorboat " Bluebird " at the service of the party, and thus enabled us to reach points at Ensenada Honda, a region of low rainfall, where the vegetation is similar to that of the dry southwestern parts of Porto Rico; here we found the little spurge, *Chamaesyce serpens,* superabundant on cleared land.

Visits were made to the Polytechnic Institute of Porto Rico at San Germán, where very important educational work continues under the direction of President J. W. Harris. We made botanical studies there with Professor Palmer, and aided him in the determination of specimens for the herbarium of the institution; a rare small tree of the genus *Badiera,* hitherto known only from two other localities in Porto Rico, was observed with much interest. President Harris accompanied us on an excursion to La

Parguera, on the south coast, for the study of other interesting trees.

The entomology of Porto Rico and the Virgin Islands is receiving critical consideration by the Scientific Survey, notably aided by large collections of insects recently made by Doctor Mortimer D. Leonard, Chief Entomologist of the Agricultural Experiment Station at Rio Piedras. Organization of the investigation by Dr. F E. Lutz and Mr. H. F. Schwarz, of the American Museum of Natural History, entomological members of the Survey Committee, has resulted in the reference of collections for study and description to about sixteen expert entomologists at as many American institutions. The number of species of insects occurring in the region proves to be much larger than was known a few years ago; as now understood, their enumeration and description will require at least three volumes of the Survey publications; the two parts of volumes already published[5] are known to require supplements. The recent return of Dr. G. N. Walcott to Porto Rico, where he accomplished much pioneer work in entomology during his previous services as Entomologist of the Insular Agricultural Experiment Station, will, doubtless, be followed by additional knowledge of insects.

Other classes of invertebrate animals are also under investigation by experts of several institutions, the Vertebrate Classes having been described in Volumes IX and X of the Survey publications Among the Invertebrates, the studies of Spiders (Arachnida), by Professor Petrunkevitch, of Yale University; of the Centipedes (Myriopoda), by Professor Silvestri, of the University of Portici, Italy, and of the Crustaceans, by Miss Rathburn, Messrs. Schmitt and Shoemaker, of the United States National Museum, are progressing for publication in Volumes XIV and XV of the Scientific Survey.

Noteworthy zoölogical work has been accomplished, and large collections have been assembled by Professor Stuart T. Danforth at the College of Agriculture of the University.

Large archaeological collections have been made and preserved in Porto Rico by students from time to time. It has been our

[5] Scientific Survey of Porto Rico and the Virgin Islands, Vol. XI, Part I, Diptera, by C. H. Curran (1928); Vol. XV, Part 1, Heterocera, by William T. M. Forbes (1930).

privilege to see those brought together by Doctor J. L. Montalvo at Ponce, by the late Don Narciso Rabell at San Sebastian, by Don Adolfo de Hostos at Santurce, by Don Pedro Manclova of Coamo, and by the late Doctor Agustin Stahl. Other collections have found their way into museums in several cities in Europe and America, and the literature of Porto Rico and Virgin Island archaeology is quite extensive. Some specimens have also been collected on behalf of the Scientific Survey, and further field-work is contemplated under the direction of Doctor Clark Wissler, archaeological member of the Scientific Survey Committee, Curator in the American Museum of Natural History.

N. L. Britton.

THE LARGEST CACTUS?

The cactus of which a picture is here presented is probably the largest species reported up to the present time. It was found on the Mulford Expedition of 1921, growing abundantly on the hillsides above the Canyamina and Meguilla rivers, to the south of La Paz, Bolivia. The specimen shown was about the largest that I found. Its size is indicated by comparison with my body, as I stand beside the trunk.

Identification of the species, or even the genus, was not possible, as neither flowers nor fruits were present. Inquiry of the natives produced the most contradictory statements, even as to size and color of flowers, the information being wholly unreliable. The cuttings sent home did not retain their vitality.

The general habit of the tree is that of *Myrtillocactus,* although the branches are not nearly so stout, erect, and rigid. Indeed, no other large tree cactus that I have ever seen possesses so lax and open a habit of branching. The branches vary from triangular to pentangular, the ribs being acute and very large.

The plants grow on hillsides, but not far from water, and in the midst of dense jungle and low forest. Several hours were required to clear away the jungle so that the picture could be taken.

H. H. Rusby.

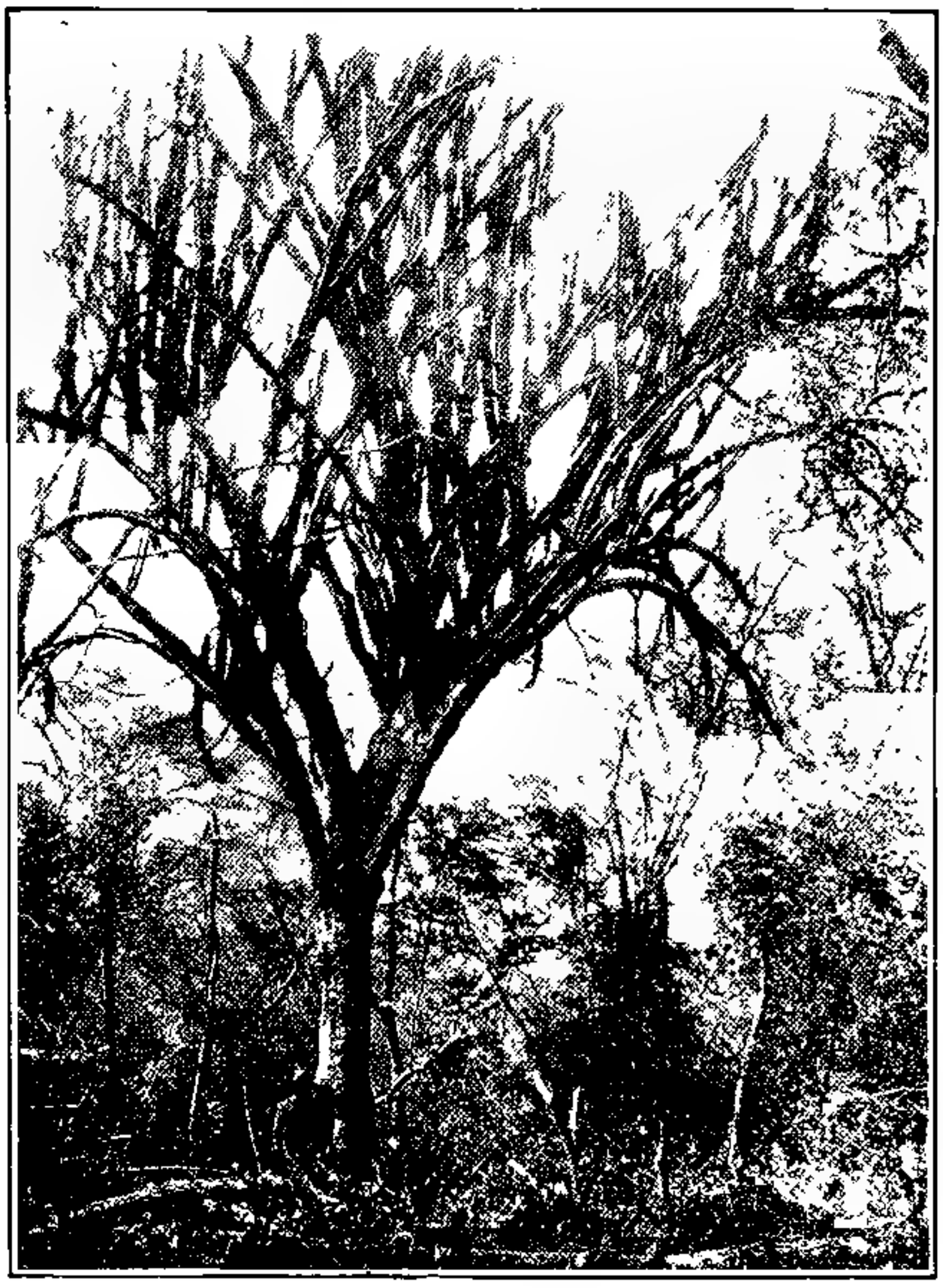

FIGURE 1. A large Bolivian cactus.

A GLANCE AT CURRENT LITERATURE[1]

Beginning with the thesis that "There is no such thing as ptomaine poisoning, as the term is commonly used," Dr. Charles H. LaWall presents in exceptionally interesting form a discussion of food poisoning and poisonous foods in the *American Journal of Pharmacy* for June, 1931. Actual ptomaine, he points out, can occur only in foods so far putrefied that no human being would consider eating them.

He deals with other myths of food poisoning, and with actual instances as well, pointing to the dangerous properties of peach

[1] All publications mentioned here—and many others—are available in the library of The New York Botanical Garden, in the Museum Building.

kernels, bitter almonds, cherry pits, water- and poison-hemlock, and certain mushrooms, adding, " If you intend eating mushrooms of doubtful character, please leave a specimen of the fungus for the botanist to identify so the physician may use the proper antidotal and corrective treatment, if he knows it."

The ancient (and not so ancient) epidemics of St. Anthony's fire, caused by eating ergotized rye, are described by the author, as are historic attacks of lathyrism, from eating dried peas with which a certain vetch is mixed; milk sickness, the cause of which is not yet wholly determined; death from eating poisonous honey, such as supposedly overtook Xenophon's army; and cases of illness from an excess of solanine in potatoes.

" Potatoes belong to the same poisonous family that yields the night shade and the datura, both of which are deadly poisonous," says Dr. LaWall, "but pshaw! so do tomatoes and eggplants, so why worry?"

* * * *

Studies of plant diseases occupy a large number of the pamphlets received lately by the Botanical Garden. The silver-leaf disease of plums and peaches has come out in a reprint from the *Journal of Pomology and Horticultural Science,* by F. T. Brooks and G. H. Brenchley. " Protecting Orchard Crops from Diseases and Insects " is the title of Bulletin 498 of the Cornell University Agricultural Experiment Station, prepared by C. R. Crosby, W. D. Mills, and W. E. Blauvelt. " Diseases of Small Grains " are treated in a new revision of Bulletin 157 of the Extension Department at Cornell. J. D. Wilson and H. A. Runnels, in *Phytopathology* for July, tell of the dangers of Bordeaux mixture in increasing drouth injury, as noted in experiments with ginseng. Further, in the Bimonthly Bulletin of the Ohio Agricultural Experiment Station is an article on the removal of spray residue from apples.

* * * *

Anyone who wishes to know all about delphiniums will find his questions answered in Bulletin 519 of the Cornell University Agricultural Experiment Station. More than a hundred pages are devoted here to an illustrated study of the genus by Earle I. Wilde.

Dr. A. B. Stout's contribution on "The Inter-relations between Vegetative Propagation and Seed Reproduction," from the proceedings of the Ninth International Horticultural Congress in London, has just been received in pamphlet form.

* * * *

A highly decorative shrub which offers possibilities to American gardeners is the *Grevillea* of Australia, described in the July number of the *Gardeners' Chronicle of America.* The rosemary grevillea has dark-green, needle-like foliage, and flowers of pearl and rose in the shape of a nautilus shell. Another species has soft gray foliage and crimson foliage, while the prickly grevillea bears scarlet flowers against a back ground of holly-like leaves. There are also a golden and a royal grevillea. Although chiefly mountain inhabitants in their native land, the plants are said to grow well in a sandy garden soil.

* * * *

An inexpensive shade for greenhouses—one which is easily applied and which is gradually worn away or peeled off by the first frost at the end of the summer, when clear glass is again desired, is described in the June issue of the *Missouri Botanical Garden Bulletin.*

* * * *

In preparation for the many gladiolus shows to take place the country over in August, not excluding the Metropolitan show at Grand Central Palace, August 25–26, the July number of the *Gladiolus Review* gives exhibitors tips on what to enter and how to treat the flowers in transporting them to the show.

* * * *

" Buried Trees Die " is the title of an illustrated article in *The American Home* for August, in which Martin L. Davey tells how the life of a tree is frequently endangered by the grading and filling operations coincident with the building of a house, and how such danger can be avoided.

* * * *

The decline of the Mayan Empire and the depopulation of the Petén district, according to C. Wythe Cooke in the *Journal of the Washington Academy of Sciences* for July 19, 1931, may have been: (1) erosion of the soil on the higher lands used for

farming, and the consequent exposure of the rock, making agriculture impossible; (2) the filling of the lakes with silt, as a result of the erosion; (3) the consequent lessening of the water supply, important for transportation as well as every-day living; (4) resultant increase of mosquitoes in the now shallow lakes, and (5) the probable introduction or increase of malaria.

* * * *

Gardening magazines the country over are devoting many pages to rockeries. The August issue of *Better Homes and Gardens* contains two articles –one on the construction of a pool and rock garden, and one of the gathering of the rocks.

* * * *

The June issue of *La Costa Azzurra Agricola-Floreale,* published in Sanremo, Italy, gives an illustration and description of *Iris albispiritus,* one of the irises which Dr. John K. Small discovered on his spring trip to the Gulf States a year ago.

CAROL H. WOODWARD.

FISH–POISON PLANTS MAY PRODUCE IDEAL INSECTICIDE[1]

The ideal insect poison, one deadly to insects but harmless to humans and animals, has for years been the object of scientific research. Now there is promise of success, insect-fighters of the United States Department of Agriculture believe. The fact that some entomologists are convinced that insects are gradually developing resistance to the poisons now used against them has stimulated the scientists to redouble their efforts.

The most recently developed poison is *rotenone.* The department scientists have been studying it for the last three years. This poison occurs in the roots of several tropical plants, especially in "cube" (pronounced coo-bay) in South America and "derris" in the East Indies. Scientists turned to these plants when they learned that the natives use them in fishing. The natives prepare an extract from one of these roots and pour it into a stream. Even with such a wholesale dilution, the fish become intoxicated or stupefied. The primitive fishermen then gather them in. The fact that these fish are not poisonous to the

[1] From Office of Information, United States Department of Agriculture, July 21, 1931.

natives led scientists to believe that here might be a poison effective as an insecticide and at the same time harmless to man.

Though rotenone has a rapid and certain effect on fish, experiments have shown that it is harmless to warm-blooded animals when taken by mouth. A Department scientist was so sure of the harmlessness of the powder that he took a quantity of it in a capsule and suffered no ill effect. This is its great advantage as an insecticide for fruit pests. In some instances, foreign buyers of American fruit have discriminated against fruits, especially apples, which have been sprayed with arsenical insecticides. The new poison, rotenone, promises to remove cause for this prejudice.

The search for plants with insecticidal properties has been world-wide. Dr. R. C. Roark, principal chemist in charge of the insecticide division of the Bureau of Chemistry and Soils, United States Department of Agriculture, recently compiled excerpts from United States consular correspondence relating to insecticidal and fish-poison plants. Consuls in all tropical countries were asked to be on the watch for fish-poison plants and others believed to have insecticidal properties. Their reports indicate that in every tropical country there are many of these fish-poison plants. Most of the research has related to *cube* and derris roots, but the wide use of other fish poisons in the tropics indicates a field rich for investigation.

The rotenone poison research has been going on for three years, chiefly to answer two questions: Can the raw material be grown commercially and abundantly, either in the tropics of foreign countries or in our own territory or possessions? Can the poison be made synthetically? It is not definitely known whether or not it can be produced synthetically and on a commercially profitable scale, but some progress has been made in this direction.

It is an interesting fact, the scientists point out, that the natives of widely separated parts of the world have, independently of each other, discovered these fish poisons with the same chemical characteristics. The South American natives use *cube*. In the Malay States derris is used, and the natives of the African Congo use other poison roots.

Rotenone approaches the ideal insecticide because it not only kills insects that eat leaves or fruit sprayed with it, but it also

kills others if it is sprayed on them. It is both a stomach poison and a contact poison.

Rotenone promises to come into wide use. With the pioneer work of investigation already done, at least two companies in the United States are now manufacturing it on a commercial scale. It seems probable that the first principal use will be in household insect powders. Rotenone is also the basis for some animal powders, such as flea dusts.

Perhaps the largest potential uses of rotenone are as a contact poison against plant lice and as a spray against fruit insects. There appears to be an unlimited supply of raw material for the making of rotenone. Doctor Roark reports that *cube* is found in practically all parts of the upper Amazon basin in South America. Derris root is now being cultivated in the East Indies. Although *cube* grows wild, there is no reason why it should not be cultivated, Doctor Roark says.

Although research has been concentrated largely upon rotenone and the tropical raw materials from which it can be extracted, the Department specialists are also making a wide study of native plants of the United States in the hope of finding some which have insecticidal properties. A number of leads have been discovered and some of these promise to be valuable. The Depart ment chemists are also seeking a source of supply for rotenone in plants which can be raised in the United States, thus keeping the Nation independent of any other country for its supply. It is believed that cube may be grown in Porto Rico, the Philippines, and, possibly, in the Virgin Islands and the southernmost parts of the United States. Experiments to determine the feasibility of this are under way.

The cultivation of derris in the East Indies fits in well with rubber growing. Rubber trees are planted about 30 feet apart. Derris is a small shrub and is planted between the rows of rubber trees.

As yet, rotenone costs more per pound in the concentrated powder form than other ordinary insect poisons, but its greater effectiveness against some insects makes the cost of spraying with it less than with other treatments. With further development of the raw materials, there is likelihood that the poison may be produced at a fairly low cost.

PUBLIC LECTURES DURING SEPTEMBER, OCTOBER, AND NOVEMBER

Following is the program of free illustrated public lectures to be given in the Museum Building, of The New York Botanical Garden, on Saturday afternoons at 3:30 during September, October, and November, 1931. Doors are closed at 3:30; late-comers admitted at 3:45; lectures close promptly at 4:30.

Sept. 5. "Microscopic Projection of Plant Sections," Dr. W. J. Bonisteel, Professor of Botany and Pharmacognosy of Fordham University.

Sept. 12. "Flowers in Late Summer Gardens," Mr. Kenneth R. Boynton, Head Gardener.

Sept. 19. "The Gardens of the World," Colonel E. A. Havers.

Sept. 26. "Color Photography in the Garden," Mrs. Jerome W. Coombs, of Scarsdale.

Oct. 3. "Dahlias," Dr. Marshall A. Howe, Assistant Director.

Oct. 10. "Plant Distribution in Malaya," Dr. Elmer D. Merrill, Director-in-Chief.

Oct. 17. "Autumn Coloration," Dr. A. B. Stout, Director of Laboratories.

Oct. 24. "Botanical Activities in the United States," Dr. John Hendley Barnhart, Bibliographer.

Oct. 31. "The Ancestral History of Some Living Plants," Dr. Arthur Hollick, Paleobotanist.

Nov. 7. "Autumn in the Garden," Mrs. Wheeler H. Peckham, Honorary Curator, Iris and Narcissus Collections.

Nov. 14. "Some Edible and Poisonous Mushrooms from Maine," Professor H. Beaman Douglass, M.D.

Nov. 21. "A Botanist's Rambles Through the West Indies," Mr. Robert Hagelstein, Honorary Curator.

Nov. 28. "A Winter in Bermuda," Fred J. Seaver, Curator.

NOTES, NEWS, AND COMMENT

Dr. E. D. Merrill, Director-in-Chief, has been elected an Honorary Adviser in the Division of Science of the Roerich Museum of New York. Dr. Merrill has been especially interested in the activities of the Urusvati Himalayan Research Institute of this Museum.

Mr. Y. L. Keng, of the National Central University, Nanking, China, working with Dr. A. S. Hitchcock, at the Smithsonian Institution of Washington, on a Fellowship from the Rockefeller Foundation, spent several weeks at the Garden, in July and August, studying the Asiatic grasses in the general herbarium.

Dr. C. H. Kauffman, Emeritus Professor of Botany in the University of Michigan, died at his home in Ann Arbor on June 14, following a paralytic stroke in February, 1930. Professor Kauffman had been a frequent visitor at The New York Botanical Garden in connection with his notable studies of the fleshy fungi.

The 1931 Dahlia Collection of The New York Botanical Garden, at date of writing (July 22), includes 1083 plants and 428 varieties, without counting about 100 plants that have been distributed in the mixed borders. New varieties have been contributed by J. J. Broomall, Success Dahlia Gardens, Fisher & Masson, Dahliadel Nurseries, Alice Meussdorffer, Curtis Redfern, Peacock Dahlia Farms, Golden Rule Dahlia Farm, Stumpp & Walter Co., Ruschmohr Dahlia-Growers, Henry F. Michell Company, F. A. Danker, C. Louis Alling, George L. Farnum, W. W. Kennedy & Sons, J. A. Kemp, Lyndora Gardens, W. L. W. Darnell, W. A. Burpee Co., Sunny Slope Dahlia Terraces, Albert Parella, Locust Valley Dahlia Farm, Chautauqua Dahlia Fields, Fraser's Nurseries and Dahlia Gardens, Waite's Gardens, Inc., Mrs. Seabury C. Mastick, James Smith, and E. O'Keeffe.

The daily newspapers of July 27 carried the announcement of the awarding of the first patent ever granted by the United States to a new variety of plant. This was in accordance with the plant patent act of May 23, 1930. The patent was awarded to Henry F. Bosenberg and assigned to Louis C. Schubert, of the Somerset Rose Nursery of New Brunswick, New Jersey. The patent covers a climbing or trailing rose, the "New Dawn," the patentable feature being its "everblooming" character. The new variety is said to be identical with the popular "Dr. W. Van Fleet," except that it has the habit of continuous flowering, somewhat after the manner of some of the hybrid tea roses. The patent gives the exclusive right to reproduce, use, or sell the plant throughout the United States for a period of seventeen years.

Meteorology for July. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 88° F. on the 11th; 92° on the 13th; 89° on the 22nd; and *100° on the 28th.* The minimum temperatures recorded were: 64° on the 4th; *62° on the 13th;* 66° on the 17th; and *62° on the 26th.* The total precipitation for the month was 3.49 inches.

ACCESSIONS

Museums and Herbarium

312 specimens from India. (By exchange with Forest Research Institute, Dehra Dun, India.)

259 specimens of flowering plants from Venezuela. (By exchange with the United States National Museum.)

352 specimens from Kwangtung, China. (Given by Mr. W. Y. Chun.)

225 specimens of Siberian plants. (By exchange with the University of Tomsk.)

624 specimens of flowering plants from Hawaii. (Given by Dr. E. D. Merrill.)

723 specimens of plants from India. (By exchange with the Forestry Research Institute, Dehra Dun, India.)

21 specimens of miscellaneous North American and European mosses. (By exchange with Professor J. M. Holzinger.)

797 specimens of miscellaneous North American and European mosses. (Given by Dr. George Newton Best.)

25 specimens of miscellaneous mosses of Venezuela. (Given by Mr. Henri Pittier.)

7 specimens of mosses from Wisconsin and Michigan. (By exchange with the Field Museum of Natural History.)

5 specimens of miscellaneous mosses from Texas and Arizona. (Given by Mr. Edwin B. Bartram.)

25 specimens, "North American Musci Pleurocarpi Suppl.," nos. 1–25. (By exchange with Dr. A. J. Grout.)

11 specimens of miscellaneous mosses from New Mexico, Texas, and Colorado. (Given by Mr. Edwin B. Bartram.)

52 specimens of mosses from British Guiana and Trinidad. (Given by Mr. E. H. Graham.)

25 specimens, "Musci Americani Perfecti," nos. 151–175. (By exchange with Dr. A. J. Grout.)

4 specimens of mosses from Davis Mountains, Texas. (Given by Mr. E. J. Palmer.)

9 specimens of mosses from Venezuela. (By exchange with the Field Museum of Natural History.)

4997 specimens of miscellaneous mosses of North America and Europe. (Given by Mr. Eugene A. Rau.)

4 specimens of mosses from Mexico. (Given by Mr. Edwin B. Bartram.)

50 specimens of miscellaneous mosses from Glacier Bay, Alaska. (Given by Professor Wm. C. Cooper.)

29 specimens of miscellaneous mosses from Mt. Duida, Venezuela. (Given by Mr. H. H. Tate.)

2 specimens of miscellaneous mosses from Peru. (Given by Professor F. L. Herrera.)

4 specimens of miscellaneous mosses from Washington. (Given by Dr. John W. Bailey.)

16 specimens of mosses from Venezuela, H. Pittier. (By exchange with the Field Museum of Natural History.)

59 specimens of flowering plants from South America. (By exchange with the United States National Museum.)

37 specimens of flowering plants from Japan. (By exchange with M. Fujioka.)

41 specimens of flowering plants from the Marquesas Islands. (Given by Dr. E. D. Merrill.)

137 specimens of flowering plants from Peru. (By exchange with the United States National Museum.)

290 specimens from Chihli Province, China. (Given by Mr. J. C. Liu.)

208 specimens from Kamchatka. (Purchased.)

119 specimens of flowering plants from British Guiana. (By exchange with the Royal Botanic Garden, Kew, England.)

2 photographs of wild plants of *Cryptostegia grandiflora* from along the Orange River, Fla. (Given by Mr. W. M. Buswell.)

83 herbarium specimens from India. (By exchange with the Madras Herbarium.)

4 specimens of iris pods. (Given by Mrs. A. H. Ellender.)

6 specimens of *Limonium angustatum*. (By exchange with Mr. W. M. Buswell.)

398 specimens of flowering plants from California and Lower California. (By exchange with Stanford University.)

30 specimens of flowering plants from Cuba. (By exchange with Dr. J. T. Roig.)

1 specimen of fibre from *Chamaerops humilis* from Morocco. (Given by the Otto Gerdau Co.)

6 specimens of flowering plants from North America. (By exchange with the Field Museum of Natural History.)

2 photographs of *Cryptostegia grandiflora* in Florida. (Given by Mr. W. M. Buswell.)

80 specimens of flowering plants from Cuba. (By exchange with Mr. J. G. Jack.)

25 specimens of flowering plants from Cuba. (By exchange with Brother León.)

4 specimens of miscellaneous mosses from Trinidad, West Indies. (Given by Mr. W. E. Broadway.)

15 specimens of miscellaneous mosses from Venezuela. (Given by Mr. Henri Pittier.)

23 specimens of mosses from Cuba—Santa Clara and Pinar del Rio. (Given by Brother León.)

61 specimens of mosses from Honduras. (By exchange with the Field Museum of Natural History.)

4 specimens of Wisconsin mosses. (Given by Mr. N. C. Fassett.)

1 specimen of moss from Melrose, Mass. (Given by Mr. C. C. Kingman.)

1 specimen of moss from Mt. Lemon, Arizona. (Given by Dr. Joseph Bequaert.)

1 specimen of moss from Memphis, Tenn. (Given by Rev. C. H. Demetrio.)

1 specimen of moss from Montreal, Canada. (Given by Rev. H. Dupret.)

2 specimens of moss from British Columbia, Canada. (Given by Mr. F. A. MacFadden.)

4 specimens of miscellaneous mosses from Texas and Alaska. (By exchange with Dr. A. J. Grout.)

5 specimens of Pleistocene mosses from Washington. (Given by Professor E. W. Berry.)

PUBLICATIONS OF

THE NEW YORK BOTANICAL GARDEN

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JOURNAL
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NOTES, NEWS, AND COMMENT

ACCESSIONS

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GLADIOLUS BADLY INFESTED WITH THRIPS

During the month of July complaints began to come in of the great damage being done by thrips to the gladiolus in the vicinity of New York. Several of the earlier varieties in the plantings at The New York Botanical Garden also became heavily infested. The usual remedy recommended for the control of thrips in flower gardens is spraying with a solution of nicotine sulphate to which some soap has been added as a spreader. In recent years pyrethrum in various forms is also much used.

On July 15 our plants were thoroughly sprayed with Black Leaf 40 at a strength of 1:800, with 5 pounds of fish-oil soap dissolved in boiling water added per 100 gallons. Yet August 1 the thrips were rapidly increasing in number. As the flowers of the earlier varieties were now coming out it was decided to try a pyrethrum compound to avoid spray injury. A solution of Red Arrow Insect Spray, 1:600, was applied, using, as before, a nozzle which gave a very fine spray at 300 pounds pressure. No injury to open flowers was noted, but by August 4 the insects were still actively working. A solution of Volck, 1:50, was then applied to the plants in a portion of the Garden. The results were not altogether satisfactory. Black Leaf 40, at 1:400 strength, plus 5 pounds of soap, was used in another planting. This is double the strength recommended by the manufacturers. We have found that in trying to control leaf-hoppers on dahlias the plants can be sprayed once a week with this strength of nicotine sulphate and soap solution without injury to the foliage. Later, when the flowers appear, a pyrethrum compound is preferable on account of its giving less injury to the petals. The double strength solution of Black Leaf 40 was again put on all of the

gladiolus plants August 8. This is rather a drastic treatment. Some injury to the more tender flowers was noted, as was to be expected. The seriousness of the infestation seemed to justify the experiment. On August 13 the double strength solution was applied only to that part of the planting where only a few flowers were showing, and the remaining portion was sprayed with the usual strength, 1 : 800. At this writing (August 20), it looks as if the spread of the insects had been checked. But the use of the double strength solution is probably not advisable.

While making the photograph for the picture shown in FIGURE 1 it was noticed that the thrips quickly disappeared under the flower scales when exposed to bright light, but came out again in the shade or when the plants were covered with a paper. One can see very few of the insects on the plants when the sun is shining brightly. From this it is clear that spraying, to be effective, must be done on cloudy days or late in the afternoon or perhaps very early in the morning. It was necessary to save our flowers for exhibition purposes during the later part of July and throughout August, and it was therefore impossible to spray the plants at sufficiently frequent intervals and at the right time of day.

Dr. C. C. Hamilton, of the New Jersey Agricultural Experiment Station, on July 18 issued a special service bulletin on infestation of the gladiolus by thrips, and more recently has sent the writer additional suggestions as to the use of arsenate of lead and treatment of the "bulbs" or corms. This information should be of great interest to gladiolus-growers, and through the courtesy of Dr. Hamilton it is given below:

"THRIPS ATTACK GLADIOLUS"

"Two kinds of small slender insects known as thrips are infesting gladiolus plants in New Jersey, according to reports received from various parts of the state.

"One of these groups of plant insects is the lily thrip (*Liothrips VanEeckei* Priesner), which is found principally on the gladiolus corms as they are taken from the ground, and while in storage. Another of these pests is the gladiolus thrip (*Taeniothrips gladioli* Moulton), which usually infests growing plants. This latter species, which injures the stems, foliage, and flowers, is now causing the most damage in New Jersey gardens.

"Results of attacks by gladiolus thrips are first noticed as whitish streaks on the leaves or the petals of flowers. Frequently the

FIGURE 1. Gladiolus thrips injury. (About natural size.)

flowers open imperfectly. Injuries to the stems of the plants, particularly the parts enclosed by sheaths of the leaves, appear as black or brown spots. These injuries are caused by thrips laying their eggs in the plant tissues. An examination of affected areas with a microscope or high-powered hand lens will disclose the ends of the eggs, or the oval-like cavities where eggs are laid and from which the young thrips have hatched.

" Attempts to prevent this injury by thrips on growing gladiolus will be only partially successful, because the insects hide and feed inside the buds or around the folded leaves or sheaths of the plants where they cannot be reached easily with poisonous sprays or dusts. Plants or flowers that have been seriously injured by heavy infestations should be cut off 6 to 10 inches from the ground and the injured parts destroyed by burning or some other method which would make it impossible for the thrips to escape. This practice destroys many thrips that might migrate to uninfested plants.

" Observations have shown that the thrips come out onto the leaves and feed some during the cool part of the day. It is possible that spraying the plants thoroughly with arsenate of lead, 2 pounds to 50 gallons of water or 1 ounce to 2 gallons of water, will kill the thrips when they feed outside.

" The leaves are hard to wet, and the addition of wheat flour, glue or paste will give an even distribution of the poison. These spreader materials should be used in amounts equal to the lead arsenate.

" The application of a spray of nicotine and soap or of pyrethrum and soap will kill all the thrips it hits. Apply the spray at the strength recommended for plant lice by the manufacturer. If the spray is one that does not contain soap, add enough of this material to bring the soap content up to one half of one per cent of the diluted spray. It probably will be necessary to make four or five spray applications at six- or seven-day intervals to reduce the injury to the plants.

" When the bulbs are removed from the ground in the fall they should be examined for thrips, and if these insects are found the bulbs should be dipped for 15 to 20 minutes in a solution of free nicotine in water. The nicotine should be used at the rate of 1 ounce to 3 gallons of water. The bulbs should then be dried thoroughly before putting away for storage. If thrips are present on the bulbs in the spring they should be dipped in the nicotine solution before planting."

Dr. R. P. White, of the New Jersey Experiment Station, also believes that treatment of the corms will serve to prevent much of the trouble. He says in a letter to the writer:

" Personally I believe the best method of cleaning up an infestation is to treat the dormant corms after curing and cleaning with a pyrethrum soap or nicotine soap solution. The thrips overwinter on the corms and cause certain scarifications of the flesh of the corm during the storage period. Furthermore, they multiply rapidly during this period. I am going to dip all my corms which I have under experimentation, which number about 7,000, in nicotine soap solution as early as possible this fall."

" In regard to a question which Dr. Howe raises, I would say that I am not going to remove the scales from my corms before treating this fall. I have not decided upon the length of treatment which I will give in the nicotine-soap solution, but I rather expect it will be at least a one-hour treatment. I think this length of treatment will penetrate at least most of the husks and will kill most of the thrips—how many will remain to be seen."

Dr. C. A. Weigel, of the Bureau of Entomology, Washington, D. C., states in a letter of August 13 that the problem is apparently very acute and complicated further by the fact that several species of thrips may be involved. He recommends spraying with a solution of nicotine sulphate and soap, although some relief may result from the use of alcoholic extracts of pyrethrum as well as from derris preparations. He says further:

" Preferably several spray applications should be made before the appearance of the flowers and buds in order to reduce the infestation to a minimum. Now that the flowering stage has been reached and favorable hiding places for the thrips have increased in number, the control is more difficult. The flowers should, therefore, be cut as near the bud stage as possible and removed from the plantings to prevent the escape and return of the thrips. Then the spray applications should be made and this same procedure followed before each spraying. To get the best results it will be necessary to spray at weekly or ten-day intervals throughout the season, and the spraying must be done thoroughly by applying the insecticide to all surfaces in order to hit all exposed insects. One cannot expect to hold down an infestation with only one or two applications during the summer or with regular but carelessly made applications."

Dr. Forman T. McLean, who has just returned from the American Gladiolus Society meeting in Cleveland, Ohio, reports that gladiolus thrips were very serious in Ohio in 1930, and are doing a great deal of damage this year also.

E. A. Herr of the Department of Entomology of the Ohio Agricultural Experiment Station has recommended tentatively the following formula, which is the most promising of those tried out to date by him.

"Bindex"	4½ level tablespoonfuls
Nicotine sulphate	3 tablespoonfuls
Lead arsenate	2½ ounces
Water	5 gallons

It is suggested that this insecticide be applied at weekly intervals until the spike begins to shoot, and thereafter every other day.

As our applications of nicotine sulphate and soap have been made at about weekly intervals only, this may account in part for our failure to obtain more complete control. The use of lead arsenate, which would leave a white covering on the leaves, would prove objectionable where the flowers are grown for exhibition purposes. For this reason we have not tried out the arsenate in connection with our spraying work. Soap, of course, would not be added where nicotine sulphate and lead arsenate are combined. It remains to be seen whether frequent application of arsenate of lead might not be followed by spray injury.

B. O. Dodge.

THE WILD PEPPER–PLANTS OF CONTINENTAL UNITED STATES[1]

The only relative of black pepper in the northern part of eastern temperate North America, is in a family once removed from the true pepper family. It is the common lizard's-tail, terrestrial herbaceous plant with aromatic creeping stems, broad leaf-blades, and a spike of fragrant white flowers.

[1] The genus *Peperomia,* in the United States, seems to be confined to Florida. It was at one time reported to grow as far north as Charleston, S. C. At present it is common north of the mouth of the St. John's River in Florida, but it has not been found further north in recent years. There is no good reason why it should not be found on the coast of Georgia. These records and illustrations were made possible by the exploration in Florida through the interest of friends of the Garden.

FIGURE 1. *Peperomia floridana* on a rotten log in Shield's Hammock, homestead country of the Everglade Keys, Florida. This, the most common species of the tropical hammocks of the Everglade Keys, inhabits the trunks of living trees and decaying logs. It is typically epiphytic.

In southern temperate regions, however, several members of the pepper family itself are represented in parts close to the northern tropics. These plants are characteristic of moist or humid habitats, have creeping stems, broad leaf-blades, and spikes. They are, however, humus plants, either epiphytic, terrestrial, or epipetreous. The plants are so unusual in our floristics that they are unusually fascinating.

The botanical generic name—*Peperomia* –is a Greek word for pepper. The original specimen came from South America. The species are most numerous in the American tropics, particularly in South America. They are also plentiful in the Old World tropics. The genus considered from a historical standpoint may contain between four and five hundred species. A few species are now extra-tropical. One is endemic in the Bermudas. Five species occur in southern Florida. These are the only representatives of the genus in the United States.

The recording of these plants within our limits was a slow process. Up to the period when our explorations of the little-known or botanically unknown parts of Florida began, only two species were on record. Both of these are endemic species, although one masqueraded for many years under the name of one of the wide-spread tropical American species.

In almost any large greenhouse one may see specimens of the genus *Peperomia,* or, in common parlance, the wild pepper-plant. Some are cultivated as show plants, others merely for the general interest centered about the rather odd relatives of the plant from which the black pepper of commerce is derived.

The wild peppers are low soft-succulent herbs, usually copiously leafy, with elongate, simple or branching, spadix-like spikes with peltate bracts. The flowers are minute, consisting of a pair of stamens and a pistil. The fruits are minute berries, usually partly imbedded in the inflorescence-rachis. The flowers are usually not fragrant, but the herbage of some species is aromatic or gives off a spicy aroma.

The genus *Peperomia* differs from *Piper,* to which the black pepper referred to above belongs, in the entire or brush-like stigma. Most of the species thrive under cultivation in conservatories, if due attention is paid to temperature and moisture.

Discovery of Peppers in Florida

More than a hundred years ago (1821) Nathaniel A. Ware,[2] a scholar and a traveler, made a collection of plants in "East Florida." The specimens came promptly into the hands of Thomas Nuttall.[3] During the following year (1822) Mr. Nuttall published a paper based on Mr. Ware's collection under the title "A catalogue of a collection of plants made in East Florida during the months of October and November, 1821, by A. Ware, Esq."

[2] Nathaniel A. Ware (1780–1845) is said to have been a native of Massachusetts, but most of his life was spent in the southern states. He studied and practiced law in South Carolina, but settled at Natchez, Mississippi, in territorial days (before 1817), and there amassed a considerable fortune. In later years he lived in Philadelphia and Cincinnati, and he died in Galveston. His interest in the natural sciences was well known; Nuttall described many new species of plants collected by him in East Florida and West Florida, and dedicated to him the cruciferous genus *Warea*.—John Hendley Barnhart.

[3] Thomas Nuttall (1786–1859) was a native of Yorkshire, where in his youth he learned the printing trade, and in company with his young friend John Windsor (1787–1868) familiarized himself with the plants of that part of England (notwithstanding the statements to the contrary to published biographies). Coming to America about 1808, and continuing work at his trade, he devoted more and more attention to the strange flora of his new home, until at last he gave up all of his time to botanical study. His first extended western trip was in 1811, when he and John Bradbury (1768–1823) accompanied the overland Astorian expedition as far up the Missouri as the site of Bismarck, North Dakota. In 1818 he published his little classic, "Genera of North America Plants," setting most of the type himself. In the fall of the same year he set out upon his 5000-mile journey into the little-known Arkansas country, returning to Philadelphia in the spring of 1820. From 1822 to 1834 he was curator of the botanic garden at Harvard, where he was known as professor and served as such, although there was at that time no professorship in botany. During this period he became interested in the study of birds, and published his "Manual of the Ornithology of the United States and Canada" in 1832. In 1834 he crossed the continent, in company with John Kirk Townsend (1809–1851), on the second Wyeth expedition, and he spent most of the year 1835 on the Pacific coast and in Hawaii, returning around Cape Horn. At the end of 1841 he returned to England, where he spent the remainder of his life, with the exception of a few months in the United States in 1847–48. His English home was a small estate, "Nutgrove," at Rainhill, near Prescot, Lancashire, left to him by an uncle, upon the condition that he should occupy it at least nine months of each year.—J. H. B.

FIGURE 2. *Peperomia obtusifolia* on a horizontal branch in one of the Royal Palm hammocks in the Cape Romano region, Florida. This tropical American species is known in Florida in the Cape Sable and the Cape Romano regions. The plants grow on trunks and limbs of trees and in humus on the hammock floor. However, they are typically epiphytic.

That paper contained the first reference to the occurrence of the genus *Peperomia*—there recorded under *Piper*—in the United States or north of the Straits of Florida. South of the straits, in the West Indies, as well as in tropical continental America, many species of *Peperomia* had already been found.

Florida had been ceded to the United States by Spain only two years previous to the discovery of the *Peperomia* referred to above. Westward it extended all the way from the Atlantic Ocean to the Mississippi River. The territory was sparsely settled by a few white people and by runaway negro slaves in the northern parts, by remnants of the aborigines and some Caribs in the peninsula, by various Seminoles or deserting Creeks in the upper part of the peninsula and adjacent territory, and by Bahamian and Cuban immigrants on the islands of the Florida Reef south of the peninsula.

Notwithstanding various collections made in different parts of the state subsequent to the discovery of Mr. Ware, the genus *Peperomia* did not figure again in the botanical literature of Florida until more than half a century had elapsed. Then, fifty-odd years after Mr. Nuttall described the first species for the state, a second one *Peperomia floridana* (FIGURE 1) —was discovered in southern Florida, and sixty-odd years elapsed before this second species was formally recorded in our botanical literature,[4] under the name "*Peperomia magnoliaefolia* C. DC."

It was ten years before further discoveries once more brought the genus *Peperomia* to notice in Florida. This was in 1894, when a third species—*Peperomia humilis* (FIGURE 4)—was discovered in the southern extension of the Gulf Hammock region, by F. L. Lewton.[5] This plant was confused at first with that originally found in Florida, and only through more recent collections resulting from extensive explorations and subsequent studies was its true status established.

[4] Chapman, Flora Southern United States, ed. 2. 645. 1884.

[5] Frederick Lewis Lewton (1874–) was born in Cleveland, Ohio. His professional training was in chemistry, and he was for ten years an instructor in that science at Drexel Institute; but during the same period he served the Philadelphia Commercial Museum as economic botanist, and since 1904 has been engaged in botanical work in Washington, D. C., for eight years in the Department of Agriculture, and from 1912 as curator of the division of textiles of the National Museum.—J. H. B.

The fourth species for the Florida flora—*Peperomia spathulifolia* (FIGURE 3)—was not discovered until about twenty years after the next preceding one. This is not closely related to any of the species considered above. It really constitutes a separate group.

At the end of another decade and a half, the Cape Sable region of Florida became more accessible, and yet another, the fifth, species of *Peperomia* came to light—*Peperomia obtusifolia* (FIGURE 2). It is very abundant in the low hammocks in the vicinity of West Lake.

Thus we now know definitely five species of *Peperomia* on the Florida peninsula—though the genus has thus far escaped notice on the Florida Reef, if it really is represented there. The present knowledge, the geographic distribution, the abundance, the peculiar habitats, and the taxonomic relationships have been obtained by our intensive explorations during the past score of years.

WHERE THE WILD PEPPERS GROW

The ancestors, more or less remote, of the Florida wild peppers were evidently in the West Indies. The seed-like fruits—technically drupes—have a sticky coat and could have been brought across the Gulf Stream on the plumage of migratory birds. Where the different species got their start in the Florida peninsula we do not know. Whether their ranges have increased or decreased we do not know. However, through our explorations we now know the general geographic distributions quite thoroughly.

In the following notes these wild peppers are considered in the sequence of their taxonomic relationships.

It is interesting that *Peperomia cumulicola* (FIGURE 5), the first discovered in our range and one of the two endemic wild peppers in Florida, should be confined to the mounds and former habitations of the Florida aborigines the shell middens of the upper eastern coast and certain limestone caverns on the western shore of Lake Tsala-Apopka. An explanation of this association of the plant with aboriginal culture would perhaps be most interesting. The specific name used here is in reference to its occurrence on shell mounds.

FIGURE 3. *Peperomia spathulifolia* in the Hattie Bauer hammock in the homestead region of the Everglade Keys, Florida. Otherwise it is known only from the Bahamas and Hispaniola. Contrary to the habitat of our other leathery-leaved species—*P. floridana* and *P. obtusifolia*—this plant is epipetreous in Florida. It inhabits the eroded limestone of the hammock floor or covers the perpendicular walls of large erosion holes, as shown at the left. The foliage gives off a spicy fragrance in drying. The flower-spikes are very fragrant.

This *Peperomia* is not typically associated with any West Indian plants, except in the caverns referred to above, where it is intimately mixed with the growth of a peculiar grass, *Pharus*.[6] The plant grows well in cultivation in southern Florida and under glass northward, but it has proved a failure as a ground cover, because in cultivation it maintains the same routine of growth as in its native haunts. The plants develop luxuriantly in the fall and flower in December. The flowering stems then die down and the underground stems remain almost dormant through the earlier months of the succeeding year; they then gradually form stolons from which the new flowering stems arise in due season.

Unlike the preceding species, *Peperomia humilis,* although a close relative, is associated with numerous typically West Indian plants in our range. It is itself an inhabitant of some of the West Indian Islands. The discovery of this plant on the North American mainland has already been referred to. The second collection was made in the Cape Sable region in 1904 by A. A. Eaton.[7]

It was rediscovered there, near Coot Bay, by the writer and his associates, about a decade later—April, 1916. In December of the same year the writer found it in a hammock of tropical American vegetation along the eastern coast south of Fort Pierce.

[6] Journal of The New York Botanical Garden 21: 37. 1920.

[7] Alvah Augustus Eaton (1865–1908) was a native of Seabrook, New Hampshire, and spent his youth there and at Salisbury, Massachusetts. After graduation from the Putnam School, at Newburyport, Massachusetts, he taught school for several years, most of the time in California; he was afterward engaged in business as a florist at Seabrook, his birthplace; and for the last six years of his life he was connected with the Ames Botanical Laboratory at North Easton, Massachusetts. He devoted much time to botany for years, his chief interest being in ferns and in the allied genera *Isoëtes* and *Equisetum;* his studies were, however, by no means confined to these groups. While connected with the Ames Laboratory, he accompanied Ames and Leavitt on a European botanical trip, in 1905, and visited southern Florida on collecting trips three times: in November and December, 1903; in May and June, 1904, and in February and March, 1905. He visited Miami on each trip, devoting particular attention to its vicinity, including the Everglades, the Keys, and the Everglade Keys, as far as Royal Palm Hammock. In 1904 and 1905 he also visited the west coast. For many years his health was very precarious, and he died at North Easton, Massachusetts, several weeks before his forty-third birthday.—J. H. B.

Curiously enough, it has not been found on the Everglade Keys, where tropical vegetation dominates.

The plants also thrive in cultivation and under glass in the North, but they show the same habit of seasonal routine as do those of *P. cumulicola.*

FIGURE 4. *Peperomia humilis* growing in the humus of a hammock near Fort Pierce, Florida. Although the plants of this species are terrestrial, they occur only where at least a thin layer of humus covers the ground. In the Cape Sable region, where humus commonly six to twelve inches thick occurs, the plants grow very luxuriantly.

In December, 1920, the most extensive growth of this plant yet seen in Florida was discovered in the low hammocks of the lake region back of Cape Sable. There it covered acres of mangrove swamp and thrived luxuriantly, making flowering stems two feet tall.

The third species, in the botanical sequence, is *Peperomia spathulifolia.* Its range is the most restricted in every way of the five species under consideration. It is definitely known to grow in only one high-land hammock, the Hattie Bauer hammock near Naranja in the "Homestead Country." The species is known

on the other side of the Gulf Stream only in the Bahamas and Hispaniola.

Upon entering any hammock on the Everglade Keys, one of the more peculiar plants to meet one's eyes is *Peperomia floridana,* the second endemic species of the state. It grows on the trunks and branches of rough-barked trees, particularly on the live-oak (*Quercus virginiana*), where it is often intimately tangled up with epiphytic ferns, bromeliads, and orchids, as well as with mosses and hepatics.

This species grows in hammocks slightly further north than the Everglade Keys along the eastern borders of the Everglades, but neither as abundantly nor as luxuriantly. Occasionally it assumes the form of a vine with elongate and even somewhat twining branches.

It was apparently first found in Florida, perhaps in the Brickell Hammock, which is now in the city limits of Miami, in 1877, by A. P Garber.[8]

Although an epiphyte, plants of this species also grow well planted in soil, under cultivation in the conservatories.

The first species of *Peperomia* discovered in Florida came from near the northern extremity of the state, as noted above. The last addition to that genus came from the southern extremity of the peninsula. It is a West Indian plant and grows together with typically West Indian floristics which exist on the present main land of Florida. This one grows in low hammocks where the water-table is nearly at the surface of the ground or, in wet weather, above it. Its habit of growth resembles that of *P. floridana,* but it never occurs in such dense mats as the colonies of that species sometimes assume. It has a more sprawling mode of growth, and its larger leaves make it a more conspicuous plant than its relative.

[8] Abram Paschall Garber (1838 1881) was born at Columbia, Lancaster County, Pennsylvania. He was a graduate of Lafayette College (1868), and studied medicine at the University of Pennsylvania (M.D, 1872). Compelled by ill health to seek a warm climate, he went to southern Florida about 1877, and spent several years there, devoting much attention to the collection of plants in that hitherto little-known region. He spent two seasons at what is now Miami. He also collected in Porto Rico in 1880. In 1881 he returned to Pennsylvania, where he died, at Renovo, in Clinton County.—J. H. B.

Peculiar Habitats of These Five Species

Second only to the plants themselves are their peculiar habitats, in attracting one's attention.

Again considering the species in their taxonomic sequence, we find that *Peperomia cumulicola* is a humus plant. It grows only

Figure 5. *Peperomia cumulicola* growing on kitchen-middens near Port Orange, Florida. As far as known, this plant occurs only on the shell heaps left by the Florida aborigines. It thrives in the humus and sand which has collected between the shells and forms a ground-cover in its growing season. Winter is its flowering season.

in the humus that has accumulated among the shells and other elements of the aboriginal kitchen-middens and refuse heaps. Although a very tender plant as respects cold, this peculiar habitat enables it to exist further north than any of the other species. Its relative, *Peperomia humilis,* is also a humus plant, but occupies a quite different stratum. The colonies, large or small, occupy a layer of humus that has accumulated over siliceous sand, limestone rock, or marl.

In the broad sense, the plants of these two species are terrestrials. In their habit of growth their main stems or rootstocks are beneath the surface of the strata they grow in. The flower-

stems are erect, bear succulent leaves, and terminate in a simple or branched green rachis bearing scattered flowers and fruits.

Another kind of habitat and habit is met with in *Peperomia spathulifolia.* The plant is a vigorous grower, often covering large areas of the rocky hammock floor and copiously decorating the edges and upper parts of the walls of lime-sinks or erosion holes. The main stems are aërial, often elongate and vine-like as in the two following species. The leaves are somewhat coriaceous; but a more striking difference lies in the slender, branching, pliable inflorescences with nodding tips, just as in the case of its relative, the lizard's-tail (*Saururus cernuus*) mentioned above.

The inflorescence rachis is white and at anthesis delightfully fragrant, characteristics not known in our other wild peppers. Another peculiarity is the herbage, which in drying is decidedly and pleasantly aromatic, much more so than it is in any of our other species.

Although plants of it may grow about the bases of trees upon which *Peperomia floridana* grows, the present species never exhibits any inclination to assume the rôle of an epiphyte.

The two following species—*Peperomia floridana* and *P. obtusifolia* are epiphytic. However, the plants of each species occupy different kinds of tree-habitats. The typical habitat for *Peperomia floridana* is the sound bark of living trees. There it maintains colonies that persist for long periods and grow into dense mats. Although epiphytic, these plants, like many other epiphytes, are humus plants to the extent of growing in as much decaying vegetable matter—twigs, leaves, inflorescence, and fruits—as constantly collects in the meshes of the colony. The second species *P obtusifolia*—although also epiphytic, is more of a humus plant than *P. floridana,* for its favorite habitat is decaying bark, on trunks and limbs and well-decayed logs.

The habits of the two epiphytes are in striking contrast to those of the other species. The thick coriaceous leaves on the aërial stems and the stout, strict, simple or sparingly branched, green rachises completely and densely covered with flowers and fruits place these wild peppers in a group by themselves and isolate them from the other species in our range.

As mentioned above, no species is known to occur on the Florida Keys. Had these unique islands been botanically explored

before they were disgracefully devastated, or were it possible thoroughly to explore the few primeval hammocks still extant at all seasons of the year, the discovery of West Indian wild peppers in addition to those occurring on the mainland would have been—and may yet be—brought to light.

JOHN K. SMALL.

HIGGINS'S OUR NATIVE CACTI[1]

This little book of 170 pages is well written and illustrated. The index and the fine color plates make it both a useful and attractive guide to the student and would-be grower of our native cacti, and it is sincerely hoped that it will stimulate interest in the cacti and their conservation as well as their culture. Many of the native species are admirably illustrated in it with pictures of the plants in flower, and the descriptions are apparently, many of them, made from personal acquaintanceship with the cacti of the Southwest, both in their native homes and in the gardens of California, with many of which the author is evidently intimately familiar.

The greater part of the book is devoted to discussions of the varieties of cacti and their characteristics and habitats. One chapter is given to culture. A novel feature is a chapter of questions and answers in which some of the most obvious queries of the amateur are clearly answered. In the answer to the one on books on cacti available for the average reader, there might readily also have been included Dr. Houghton's recently published book, "Cacti." There are also the two complete volumes of the *Journal of the Cactus and Succulent Society of America,* published monthly, beginning in 1929. The list is otherwise an admirable one and as it is avowedly incomplete, these additions would merely supplement it.

A popular book such as this on cacti, written by one evidently so familiar with these plants and their native haunts, is well worth careful consideration not only by cactus enthusiasts but by everybody interested in these curious desert growths, either from the point of view of studying them in the wild state or attempting to grow them indoors.

FORMAN T. MCLEAN.

[1] Higgins, Ethel Bailey. Our native cacti, i–viii + 1–170. A. T. De La Mare Co., New York, 1931. [Illust.] Price $2.50.

A GLANCE AT CURRENT LITERATURE

Did you know that oranges are sometimes washed with soap and water, then thoroughly rinsed, before they are sent to market? The annual report of the Canal Zone Experiment Gardens for 1930 tells how oranges are treated after they are picked. In California they are ordinarily given a rinse of bicarbonate of soda to control decay. In the Canal Zone, when oranges, lemons, and grapefruit ripen on the trees before they attain a good color, they are exposed several hours to ethylene gas after being picked, to give them a hue acceptable in the market.

* * * *

The initial number of the *Journal of Urusvati, Himalayan Research Institute,* published by the Roerich Museum, contains a number of beautifully illustrated articles on archaeology, treating it as a science, discussing the art of excavation, picturing problems and finds of archaeology in Tibet and Himalaya, and presenting brief biographies of Lomonosov and Charles R. Lanman, to the latter of whom the edition is dedicated.

* * * *

Why anyone would choose a gritty Kieffer pear to eat is a puzzle to scientists at the Agricultural Experiment Station of Michigan State College, so J. W. Crist and L. P. Batjer are attempting to find out what causes an abundance of grit cells in the fruit and how they can be eliminated. They hope, by control of genetic factors, someday to be able to produce pears with smoother, more palatable pulp. The progress of their experiments is reported in technical bulletin No. 113, of May, 1931.

* * * *

Answers to a host of possible questions on plant-raising may be found in the 1930 report of the New Jersey Agricultural College Station and State Agricultural Experiment Station, just issued. Of special importance, outside of the customary farm crops, are the reports on peach-breeding, small fruits of all sorts, garden vegetables, and ornamental plants. One interesting experiment recorded tells of the effect of feeding narcissus bulbs with varying amounts of nitrogen, showing that more vigorous and fertile paper-white narcissus grow when the plants are deprived of nitrogen. Similar tests have been made on other plants with markedly different results.

Those interested in the study of mosses will want to see the *Annales Bryologici,* "a yearbook devoted to the study of mosses and hepatics," edited by Fr. Verdoorn and published in The Hague. Illustrated articles in French, German, Latin, and English describe bryophytes of the Philippines and Jamaica, explain them as seen under the microscope, and give other studies, including a biography of Max Fleischer.

* * * *

The Cactus and Succulent Society of America, through its *Journal* for August, announces its intent to reprint Britton & Rose's *The Cactaceae,* beginning by bringing the first volume up to date. The entire four volumes are now out of print.

* * * *

Photographs of the public gardens in Kingston and of the aquarium plant house at Hope Gardens, appearing in the annual report of the Department of Agriculture of Jamaica, make one want to take the next steamer to that lovely island; and especially so when one reads that, despite the much-talked-of depression, record crops of bananas and sugar were raised and exported last year.

* * * *

In the quarterly volume of *Landscape Architecture,* dated July, 1931, some delightful designs are given for a pool, steps, pergola, tea-house, and foot-bridge for a country estate.

* * * *

How Henry F. Bosenberg got the first plant patent for his everblooming climber, " New Dawn," is told in the *Florists' Exchange* for August 8. The plant is depicted as adaptable to various methods of growing, blooming from June until frost, and being resistant to disease.

* * * *

Means of edging the flower garden, especially where it borders a walk, are suggested in *Horticulture* for August 1. Advantages of brick, stone, sandstone, concrete, and metal borders are given.

* * * *

Those who have tramped over the sand-dunes of Long Island, or have visited estates in that region, should enjoy the description of the flora given by Alpheus W. Blizzard in *Ecology* for

January, 1931. He deals specifically with High Hill, in West Hills, but his survey is fairly applicable to Hempstead Plains, Montauk, and Shinnecock Hills.

* * * *

"Weeds How to Control Them" is a complete treatment, with illustrations, of one of the most troublesome topics of gardeners and farmers. It appears in Farmers' Bulletin 660 of the United States Department of Agriculture.

* * * *

Volume 17, part 4, of *North American Flora* has just been issued. It contains part of Poaceae (Grasses) by Albert Spear Hitchcock.

CAROL H. WOODWARD

NOTES, NEWS, AND COMMENT

Advanced proofs of the "International Address Book of Botanists," a directory of individuals, scientific institutions, universities, and societies in all parts of the world interested in the study of botany, have been received at the Garden. The volume was authorized by the Fifth International Botanical Congress at Cambridge, England, in August 1930. The committee charged with its preparation and publication consisted of the late Dr. T. F. Chipp, Assistant Director, Royal Botanic Gardens, Kew, Dr. L. Diels, Director of the Botanic Gardens, Berlin, and Dr. E. D. Merrill, Director-in-Chief of The New York Botanical Garden, New York. The volume contains over 13,000 references with alphabetic and geographic indices and is being published for the Bentham Trustees, Royal Botanic Gardens, Kew, Surrey, England. The low price at which it is being sold, $3.25 post free in the United States and its possessions and in Canada, was rendered possible by a grant from the Carnegie Corporation of New York to cover incidental expenses in connection with the compilation of the large number of data included in the book, and a loan from the Bentham Trustees. The volume may be ordered from Messrs. Baillière, Tindall & Cox, 7 and 8 Henrietta Street, Covent Garden, London, England.

The directory will be particularly useful to those interested in plants in that through consulting it they will be able to make contacts with trained individuals in almost any part of the world

from which they may desire to secure material in the form of seeds, plants, or reference specimens.

Dr. T. H. Goodspeed, Professor of Botany at the University of California, spent August 5 at the Garden investigating *Nicotiana* in the herbarium. He had just returned from a fourteen-month trip to Europe, and while there he looked up most of the extant types of the species in this genus.

Mr. B. A. Krukoff, a professional forester, left New York on August 8 for Brazil, where he plans to remain about six months, carrying on certain technical investigations. In connection with this work he will make comprehensive botanical collections, shiping his material to The New York Botanical Garden for study and distribution. As his field work will take him into little-known parts of Brazil, in which botanical work has not hitherto been done, it is highly probable that his collection will be of exceptional value and interest. In 1930 Mr. Krukoff visited Sumatra, and in the limited time available to him while there he brought together an interesting series representing about 150 species of trees which he presented the Garden for identification.

Word has been received from Dr. Albert N. Steward, in a communication dated July 6, 1931, at Chungking, Szechuan, that he and his party had safely reached this point on their trip to Anhwei Province. Anhwei was selected for the season's botanical work, on a coöperative arrangement between the Arnold Arboretum, Nanking University, and The New York Botanical Garden. The last was enabled to participate in this important expedition through the generosity of Henry W. de Forest, who supplied special funds for the purpose.

Meteorology for August. The total rainfall for the month was 3.96 inches. The maximum temperatures recorded at the Garden for each week were: *101° on the 7th*, 88° on the 16th, 92° on the 18th, and 89° on the 25th. The minimum temperatures for each week were 67° on the 5th, 61° on the 12th, 58° on the 23rd, and *55° on the 31st.*

ACCESSIONS

Additions to the Collections of Dahlias (1931)

53 roots, 21 varieties. (Given by Dr. M. A. Howe.)

34 plants, 17 varieties. (Given by Fisher and Masson.)

30 roots, 15 varieties; and 8 plants, 5 varieties. (Given by Success Dahlia Gardens.)

27 clumps, 9 varieties. (By exchange with Mrs. A. Tennyson Beals.)

26 roots, 12 varieties. (By exchange with Mr. Albert Parrella.)

24 roots, 12 varieties; and 6 plants, 3 varieties. (Given by Peacock Dahlia Farms, Inc.)

20 plants, 10 varieties. (Given by W. Atlee Burpee Co.)

19 roots, 4 varieties. (Given by Mr. James Smith.)

18 roots, 14 varieties. (Given by Sunny Slope Dahlia Terraces.)

16 roots, 8 varieties. (By exchange with Mr. W. C. Garwich.)

16 roots, 8 varieties. (Given by W. W. Kennedy & Sons.)

15 plants, 5 varieties. (Given by Ruschmohr Dahlia Growers.)

14 plants, 7 varieties. (Given by Dahliadel Nurseries.)

12 plants, 8 varieties. (Given by Waite's Gardens, Inc.)

12 roots, 4 varieties. (Given by Mr. W. L. W. Darnell.)

10 plants, 3 varieties; 6 roots, 3 varieties. (Given by Henry F. Michell Co.)

10 roots, 6 varieties. (Given by Alice Meussdorffer Dahlia Gardens.)

9 roots, 4 varieties; and 7 plants, 5 varieties. (Given by Mr. C. Louis Alling.)

8 plants, 7 varieties (Given by Mr. J. A. Kemp.)

8 roots, 7 varieties. (Given by Mrs. S. C. Mastick.)

7 clumps, 7 varieties; and 2 roots, 2 varieties. (Given by Mrs. Carl Sherwin.)

6 plants, 3 varieties. (Given by Lyndora Gardens.)

6 roots, 6 varieties. (Given by Mr. J. J. Broomall for Success Dahlia Gardens.)

6 roots, 4 varieties. (By exchange with Mr. Leo Ritter.)

6 roots, 2 varieties. (Given by Locust Valley Dahlia Farm.)

4 plants, 2 varieties; and 4 roots, 2 varieties. (Given by Fraser's Nurseries and Dahlia Gardens.)

4 plants, 2 varieties. (Given by Golden Rule Dahlia Farm.)

4 roots, 3 varieties. (By exchange with Mrs. E. Spingler.)

4 roots, 2 varieties. (Given by Chautauqua Dahlia Fields.)

4 roots, 2 varieties. (Given by Mr. George L. Farnum.)

3 roots, 3 varieties. (By exchange with Dr. J. Hahn.)

2 roots, 2 varieties. (By exchange with Mr. E. O'Keeffe.)

2 roots, 2 varieties. (Given by Stumpp and Walter Co.)

2 roots, 1 variety. (Given by Mr. Curtis M. Redfern.)

2 roots, 1 variety. (By exchange with Miss Anna E. Robinson.)

2 roots, 1 variety. (Given by Mr. Fred A. Danker.)

1 clump. (By exchange with Mr. George Halsey.)

1 root. (Given by Mr. George Emonds.)

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GENERAL INFORMATION

Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 39,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

The following is an approved form of bequest:

I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ————.

Conditional bequests may be made with income payable to donor or any designated beneficiary during his or her lifetime.

All requests for further information should be sent to

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ACCESSIONS

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PER AXEL RYDBERG
(July 6, 1860–July 25, 1931)

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PER AXEL RYDBERG

(WITH PLATE 306)

The New York Botanical Garden has recently been called upon to mourn the loss of one who devoted nearly a third of a century to continuous service on its scientific staff.

Per Axel Rydberg, son of Adolf Fredrik Rydberg and Thekla Elfrida Otterstrom, his wife, was born in the farming community of Odh, in Molla parish, Vestergötland, Sweden, July 6, 1860. While he was still a child, his father moved to Lofvene, in the vicinity of Lidköping. He attended the royal gymnasium at Skara, graduating in 1881, and emigrated to America in the following year.

Upon his arrival in the United States, he first sought and obtained work in the iron mines of Michigan, but soon met with an accident so serious that for a time he was not expected to survive; its only permanent result, however, was a slight lameness that became more noticeable in his later years. It is quite possible that this accident, incapacitating him for manual labor and putting an end to his ambition to become a mining engineer, had something to do with his return to those intellectual pursuits for which he had been fitted by his earlier training.

From 1884 to 1890 he taught at Luther Academy, Wahoo, Nebraska, where he was in charge of the classes in mathematics. Feeling the need of a college education, he registered at the University of Nebraska, receiving the degree of B.S. in 1891. There is no doubt that it was the influence of that inspiring teacher, the late Charles Edwin Bessey, then professor of botany at the University of Nebraska, that determined his later lifelong devotion to the study of plants.

It is true that young Rydberg had been interested in botany while still a student at Skara. He had then formed a represen-

tative herbarium of Swedish plants, and his first appearance in botanical literature was in the pages of the Swedish journal "Botaniska Notiser" in 1882, the year that he left his native country. But his herbarium, and with it his special interest in botany, had been left behind; and it was not until he entered the University of Nebraska, and found there a group of enthusiastic young botanists gathered about their honored professor, that his early love of the science was rekindled, and he began to devote himself primarily to it.

It was in the year of his graduation that a botanical survey of the state was undertaken by the Botanical Seminar of the university Six students or former students of the university, with the nominal advice but under the actual direction of Professor Bessey, constituted the survey. These were: Jared Gage Smith, now living in retirement in Hawaii; Thomas Herbert Marsland, who soon drifted away from active interest in botany; Roscoe Pound, now dean of the law school of Harvard University; Per Axel Rydberg; Albert Fred Woods, now director of scientific work of the United States Department of Agriculture; and Frederic Edward Clements, now associate in ecology of the Carnegie Institution of Washington. The Botanical Survey of Nebraska published reports of its work, at first annually and then at longer intervals, and accumulated the materials for the flora of the state that was afterwards undertaken in the name of the Seminar.

In the summer of 1891, Rydberg was commissioned by the United States Department of Agriculture to conduct botanical exploration in western Nebraska, and this was followed by similar commissions in succeeding years. In 1892 his field-work was in the Black Hills of South Dakota, and in 1893 among the sandhills of western Nebraska, especially in Thomas and Hooker counties. Meanwhile he had returned to Luther Academy, where he taught the natural sciences and mathematics from 1891 to 1893.

In 1893 the Botanical Seminar of the University of Nebraska, to which he had returned for graduate study, announced a detailed flora of the state, to be published in 25 parts; of these only three (numbers 1, 2, and 21) ever appeared, and part 21, comprising the Rosales, by P. A. Rydberg, was issued in 1895. This year, 1895, was a very important one—perhaps the most impor-

tant—in his career. In that year he received the degree of M.A. from the University of Nebraska; the Rosales of the Flora of Nebraska and his Flora of the Sand Hills of Nebraska both bear that date; he spent the summer with Cornelius Lott Shear collecting plants in Montana for the United States Department of Agriculture; and at the end of the collecting trip he returned, not to Nebraska but to the vicinity of New York City, his home for the remaining half of his life.

For most of the next four years he was professor of natural sciences and mathematics at Upsala College, Kenilworth, New Jersey, meanwhile registered as a candidate for the Ph.D. degree at Columbia University; he held a scholarship at Columbia in 1895–1896, and a fellowship in 1896–1897, and received his doctor's degree in 1898. It was during this period that the writer of this sketch made his acquaintance.

In the summer of 1896 he continued his field-work in Montana for the United States Department of Agriculture; in 1897 he was sent, with Ernst Athearn Bessey, by The New York Botanical Garden, to collect in Montana and the Yellowstone Park region; and in the summer of 1898 he was employed by the Garden while working up these collections.

In 1897 a chapter of the honorary scientific fraternity Sigma Xi was established at the University of Nebraska, and in the following year Rydberg was elected a graduate member of this chapter. A few months after beginning his work at Columbia University, he was elected, January 14, 1896, to membership in the Torrey Botanical Club, the scientific society with which his work was ever after most closely associated.

Early in 1899 the permanent staff of The New York Botanical Garden was first organized. Several of its members had been in the employ of the Garden for a year or two, but the first list of the staff as such seems to have appeared on the second cover page of Bulletin no. 4, dated April 13, 1899. In this list of nine names, the fourth is "Dr. P. A. Rydberg, Assistant Curator." Eight years later, his title was altered to Curator, but otherwise it remained unchanged thereafter.

From his appointment to the staff of The New York Botanical Garden it is needless here to record the details of his life so fully, for they are better known and may be traced to a large degree in

his numerous published papers and books. These deal chiefly with the flora of the Rocky Mountains and the plains to the eastward, with monographic work on the North American representatives of certain groups of flowering plants, and with phytogeography. Some would class this last-named group of papers as ecological, but to him plant ecology was merely a phase of that much older branch of botany, plant geography.

During his years at The New York Botanical Garden, most of his time was devoted entirely to herbarium study. In 1900 he spent two months in field-work, with Frederick King Vreeland as an assistant, in southeastern Colorado. In the summer of 1901 he was in England and Sweden; this was the only time he ever revisited the land of his birth. In 1905, he was absent from the Garden for nearly three months on a collecting trip to Utah; he also visited the University of Wyoming, San Francisco, and Los Angeles at this time. In 1911 he spent several months with Albert Osbun Garrett in the exploration of southeastern Utah; this was the last time he was as far west as the Rocky Mountains.

In 1905, accompanied by John Tuttle Perry, he explored the Alleghany mountains of Virginia and North Carolina. In 1926 and 1929 his field-work and herbarium study took him to Minnesota, Iowa, the Dakotas, Nebraska, and Kansas, both of these trips being undertaken in connection with the flora upon which he was engaged at the time of his death.

In addition to the Torrey Botanical Club, already mentioned, he was a member of other scientific organizations. In 1900, the year following his appointment on the newly organized staff of The New York Botanical Garden, he joined the American Association for the Advancement of Science, and in the following year was elected a fellow of that association. In 1901, too, he was chosen an associate of the Botanical Society of America, of which he became a member in 1911. His membership in the Ecological Society of America dated from 1907; he was also a member of the American Geographic Society.

Rydberg's published contributions to botanical literature (including a flora now in press and soon to appear) fill nearly seven thousand printed pages. Among the most important are his monographic studies incorporated in the North American Flora that has been in course of publication by The New York Botanical Garden (all too slowly) for more than twenty-five years. Of

this work there have appeared so far about 5150 pages, about 2150 devoted to flowerless plants. Of the remaining 3000 pages, devoted to flowering plants, about 1250 were written by Per Axel Rydberg much more than one third of the whole.

On his forty-third birthday, Rydberg was still a bachelor, but a few months later, November 11, 1903, he married Alfrida Amanda Rydberg, the daughter of one of his cousins. They had four children. The sudden death of their oldest daughter, at the age of fourteen, was a sad blow to her parents; the only son, and the two younger daughters, remain to comfort their mother in her bereavement.

For months before his death, Rydberg's health was gradually and insidiously undermined by his fatal disease, but he continued his work at the herbarium, mornings, until the 17th of July, and even on the 24th he gave final instructions concerning the flora of which he had seen and revised about half of the first proofs. The end came early in the morning of July 25, 1931, at his home, 3304 Rochambeau Avenue, New York, N. Y.

No account of Per Axel Rydberg would be complete without some reference to his religious life. Brought up in the state church of Sweden, sometimes described as the most strongly Lutheran of all nations, he was steadfast in his loyalty to Lutheranism as long as he lived. During the earlier years in America, he was a member of Swedish Lutheran churches affiliated with the Augustana Synod, and long after he came to the Bronx to live he worshipped regularly in a Swedish church in Mount Vernon, several miles from his home. As his children grew up, however, he felt that they should receive their religious instruction in the English language, and this was his chief motive in transferring his membership to Grace Lutheran Church of Bedford Park, where all the services are in English. It was in this church that his many friends gathered, on the afternoon of Monday, July 27, to honor his memory. There were three services: a private one, at the home, in Swedish; a public one, at the church, in English; and a brief commitment service, at the grave, in Woodlawn cemetery, where rest the mortal remains of one who, all through his life, was faithful to the service of his science and his God.

JOHN HENDLEY BARNHART.

VEGETABLE DRUGS AND MEDICINES

Drugs are the substances from which medicines are made, but a drug may be used as a medicine in its own form.

It is often said that a little knowledge is dangerous, but a knowledge of even a few of the simpler facts regarding drugs and medicines can easily be made to contribute to the safety of the average individual. The percentage of people who do not possess this knowledge is remarkably great.

Most of the powerful drugs are capable of doing harm as well as good, not only through actual poisoning, but by being used when not properly required, when in excessive amount, or when producing some objectionable effect in addition to the medicinal effect desired.

When one takes a dose of a vegetable drug in its own form, as powdered digitalis leaves, mandrake root or aconite root, the greater part of the drug does not act but passes out of the system without effect, a very small portion of it being active. Thus, there is less than five pounds of quinine in a hundred pounds of cinchona bark, two pounds of strychnine in a hundred pounds of nux vomica seed, or half a pound of aconitine in a hundred pounds of aconite root. For this reason, it is usually considered best to extract the active constituent in some way, and to take this extracted matter in solid or liquid form, known as a *medicinal preparation*. When made according to a definite process and of definite strength, the preparation being adopted in medicine, it is called a *galenical preparation*. If a drug is boiled, the resulting liquid preparation is a *decoction*. If steeped in hot water without boiling, it is an *infusion*. Both of these are commonly known as "teas." It is clear that if much drug is used, with little water, the preparation must be stronger than when the quantities are reversed, hence the importance of acting in accordance with a definite formula, starting with weighed or measured amounts and ending with a definite amount of the filtered or strained liquid. I have seen a woman poison her child by taking too large an amount of a root, and boiling it too long, so that the decoction became excessively strong.

There are many drugs whose active constituents cannot be extracted with water, each constituent being soluble in its special

liquid or liquids, such as alcohol, glycerine, volatile or fixed oils, alkaline or acid solution. The particular liquid so used is called the *menstruum.* If a drug contains several different constituents which are desired in the preparation, and these are soluble in different liquids, the menstruum must be a mixture of different solvents. On the other hand, one constituent may be desirable and another not, so that it becomes necessary for pharmacists to study each and every constituent of all drugs, in order to determine the best method of making the preparations. The same care is necessary to have the quantities of drug and menstruum properly determined in all preparations, as in the case of decoctions and infusions.

It is often necessary or desirable to have preparations of the same drug of different strengths. When the number of cubic centimeters of the finished preparation is the same as the number of grams of the drug used (making approximately a pint of the preparation from a pound of the drug), the preparation is called a *fluid extract.* When the quantity of drug is much less (usually ten or twenty per cent, occasionally five or fifty per cent), the preparation is a *tincture.* Both of these preparations are made with alcohol or a mixture of alcohol and water. When a tincture or fluid extract is evaporated down to a solid condition, the product is an *extract,* or a *solid extract.* When the term "extract" is used without qualification, the solid extract is to be understood. An extract which is made by the use of water is called an *aqueous extract.* Extracts are used in the making of pills, and it requires great skill to mix the pill mass so that all the pills will contain exactly the same amount of extract.

It will be readily understood that if there is a fluid extract and a tincture of the same drug, the dose of the latter is larger, in the ratio of strength, ten times as large if a ten per cent tincture, twenty times if five per cent. Therefore, should a customer receive the fluid extract, believing that he has a five per cent tincture, and takes the dose of the latter, he is liable to be injured through over-dosage, and it may easily cost him his life. The great majority of customers, in purchasing a preparation, give only the name of the drug, as in asking for "arnica," "iodine," "larkspur," "witch-hazel," or "rhubarb." Now arnica is the dried flowerheads; iodine is a scaly mineral substance; larkspur is a

seed; and of these the average customer desires the tincture. Witch-hazel is a leaf and the customer desires its distilled liquid. Rhubarb root is often used in its own form, but usually the customer desires a liquid preparation of it, of which there are many. Most persons ask for "turpentine," but what they really want is oil of turpentine, distilled from the turpentine, which latter is a solid or semi-solid substance.

Practically all vegetable drugs are exhibited in the cases of the Economic Museum of the New York Botanical Garden, and it is intended, as soon as space and other conditions will permit, to install a complete exhibit showing the different classes of preparations of a typical drug and the processes by which they are made.

In order to protect physicians and their patients against irregularity or uncertainty in this serious matter of strength of the preparation, the responsibility of fixing the strength has been vested in two standard and authoritative books, the *United States Pharmacopoeia* and the *National Formulary*, and the Federal Government and most of the states have legalized these standards, so that any article sold under a name recognized in either of these works must comply in all particulars with the standards prescribed in that work. Thus, if the strength of the tincture of a certain drug is fixed by one of these books at ten per cent, it is illegal to supply it in any other strength, unless the difference is plainly stated on the label. Not only is this true, but the quality of the drug from which it is made is specified, as well as that of the solvents to be used in extracting it, the precise nature of the process of manufacture and the character of the finished product. For example, it is not enough to require that the cinchona bark used in making the fluid extract contains five per cent of its active constituents; the fluid extract made from it must also be assayed and found to contain the same specified amount.

A careful study of these requirements would lead to the belief that they must result in actual uniformity in the quality of the products, and in the complete protection of the public, but, unfortunately, this is not the case. The whole value of any law rests in its execution, and failure to enforce the official standards for drugs and medicines is very general.

Not only is this condition due to the neglect of public officials to enforce the law, and often to their collusion with law-breakers,

but to the fact that some of the methods employed in testing the preparations are inefficient. When the testing is done by accurate chemical processes, the result must be correct. If the chemist extracts the pure quinine from the preparation, weighs it and finds it in required amount, error is impossible, but, incredible as it may seem, a fad is now in operation for determining the medicinal strength and value of a preparation by administering it to some such animal as the cat, dog, guinea-pig, rooster, or frog, and noting the degree of reaction exhibited by the animal. The variability of such reaction in different individual animals, or in the same animal under different conditions renders this method quite unreliable. Fortunately, this fallacy affects only a small number of drugs.

It is also true that the number of drugs subject to standardization by chemical methods is relatively small. In the great majority of cases, the only method of determining the quality or the value of vegetable drugs is through their careful selection by properly trained individuals. This work is confided almost wholly to pharmacists, hence the great importance of thorough training in pharmacy schools in this art of pharmacognosy. In the case of poisonous preparations, the public are not allowed to make purchases at all, except under careful restrictions comprised in statutes known as "poison laws."

It remains to be stated that in a great many cases, instead of using the drug itself, or one of its preparations, in medicine, its active constituent is extracted in a pure condition and administered in small doses, in the form of solutions, pills, tablets, capsules, or other forms. These active constituents are of course extremely powerful and usually poisonous, and the greatest care has to be exercised in maintaining their purity and in weighing or measuring the dose to be taken. In the Economic Museum of this Garden, there is a large case of "Proximate Principles," where all of these important products are exhibited, in connection with, or in relation to, the drugs from which they are derived.

H. H. RUSBY, M. D.,
Honorary Curator of the Economic Collections.

THE BIG TREES OF CALIFORNIA[1]

There are two species of trees in California known as "big trees"—*Sequoia sempervirens* of the coastal region, and *Sequoia gigantea* of the Sierras. These two species are the only living representatives of the genus *Sequoia,* and they are confined to a limited area on the Pacific slope of the United States. If these trees should be destroyed, the genus would be extinct as an element in the living flora of the world, except for a few individual trees that have been cultivated in botanical gardens and elsewhere.

From the fossil remains, however, we have learned that the genus was formerly represented by many different species and that it had a distribution that was world-wide—at least in the Northern Hemisphere. Remains have been found in Asia, Europe, Iceland, Greenland, British America, the United States, and Alaska. It reached a maximum development in the Tertiary period. During the Quaternary period, when a large part of the Northern Hemisphere was buried under snow and ice, during the glaciation of the Ice Age, it was exterminated in the Old World, but found a refuge in North America in the limited area where the remnants of the old Sequoia forests still exist. It is in regard to the big trees of the Sierras—*Sequoia gigantea* –that we are now speaking.

All of these trees are included in twelve scattered groves, some entirely within, some partly within, and some entirely without any government-controlled reservation.

The Mariposa grove was the first one to be placed under government control and protection. It was acquired, in part, by the State of California, in 1865, and in 1890 was included, intact, in the Yosemite National Park by the national government.

The Calaveras and Stanislaus groves were the next to be acquired, in 1909, after all kinds of delays and discouraging oppo-

[1] Abstract of an illustrated lecture given at The New York Botanical Garden on Saturday afternoon, November 8, 1930. The lecture was illustrated by lantern slides of maps showing the location and extent of the several groves; views of certain of the most striking general features and of a number of the largest individual trees in the groves; lumbering operations, etc.

sition—commercial and political. Finally, however, the necessary legislation was enacted and the Calaveras National Forest was established, which included both the Calaveras and the Stanislaus groves. The tract was acquired by exchange of other government-owned timber land, on the basis of fifteen acres of average timber land for each individual Sequoia tree 100 feet or more in height!

The next and the last one of the groves acquired was the Kings River grove, although it had been badly eaten into by lumbering operations and many fine trees destroyed. In 1917 the U. S. Government authorized an appropriation of $50,000 for its purchase. The owners demanded $70,000. The National Geographic Society started a popular subscription, raised the necessary $20,000, and the third and largest of the groves was saved.

In regard to the future of these trees, one main fact has to be realized and recognized: the relatively few trees now in existence represent the remnants of a once mighty but now vanishing race, which reached its maximum of development far back in prehistoric time. Added to this, it is certain that the trees will never spread, naturally, beyond their present limited areas of distribution, and these areas will become more and more restricted and circumscribed by the advance of civilization as time goes on. They belong to past ages in the history of the earth. They are incongruous elements in the existing vegetation and are out of touch with their neighbors. Nature has marked them for extinction, and civilized man—so-called—is hastening the climax.

In general it may be said that, although the larger part of the big trees are doomed to destruction for commercial purposes, a few earnest and devoted persons, in the face of every possible discouragement, have succeeded in effecting the preservation and protection of certain of the groves by having them included in government reservations. Some have provided the necessary money, some have contributed by the exercise of political pressure and influence, some by means of their writings.

Where properly protected, the trees are able to live and to perpetuate themselves. They do not die of disease or old age. They are peculiarly free from the fungus and insect pests that ultimately destroy all of our well-known forest trees; and, barring accident, they may live, as many individual trees now in existence

have lived, for thousands of years. It has been said, by those who are competent to express an opinion, that none of the big trees dies a natural death. They come to an end, either by lightning, fire, wind, or the ax of the lumberman. Every individual big tree, if it lives long enough, is almost certain to be struck by lightning. Almost every one of the outstanding big trees shows evidence of having been struck. And lightning has often been followed by fire.

A big tree also becomes top-heavy in time. The tremendous bulk of its growth above ground ultimately becomes out of proportion to its root system, and if this system is weakened in any way, as by erosion of the soil, a wind of unusual violence is too much for the tree to withstand.

ARTHUR HOLLICK.

SECTION OF "BIG TREE" ON EXHIBIT IN THE MUSEUM OF THE NEW YORK BOTANICAL GARDEN

In 1930, through the courtesy and interest of Colonel John R. White, Superintendent of the Sequoia National Park in California, it was possible for The New York Botanical Garden to secure a section of the trunk of the "big tree," *Sequoia gigantea*. This section is about 10 feet in diameter, 1 foot thick, and weighs about 2500 pounds. The tree from which it was cut fell in 1917, and was then by actual ring count 1694 years old, having commenced its growth in 223 A. D.

This interesting exhibit was secured at a minimum expense, the actual cutting and crating of the section being done at cost through the good offices of Colonel White, while the Luckenbach Steamship Company voluntarily supplied free transportation from their docks in Oakland, California, to Brooklyn, New York.

The section was allowed to dry for several months. It was then prepared for exhibit by cinching a steel cable around it in order to close up existing cracks; minor cracks were filled by driving in thin wedges of California redwood. The surfaces were then smoothed and finished, and when this was done the section was

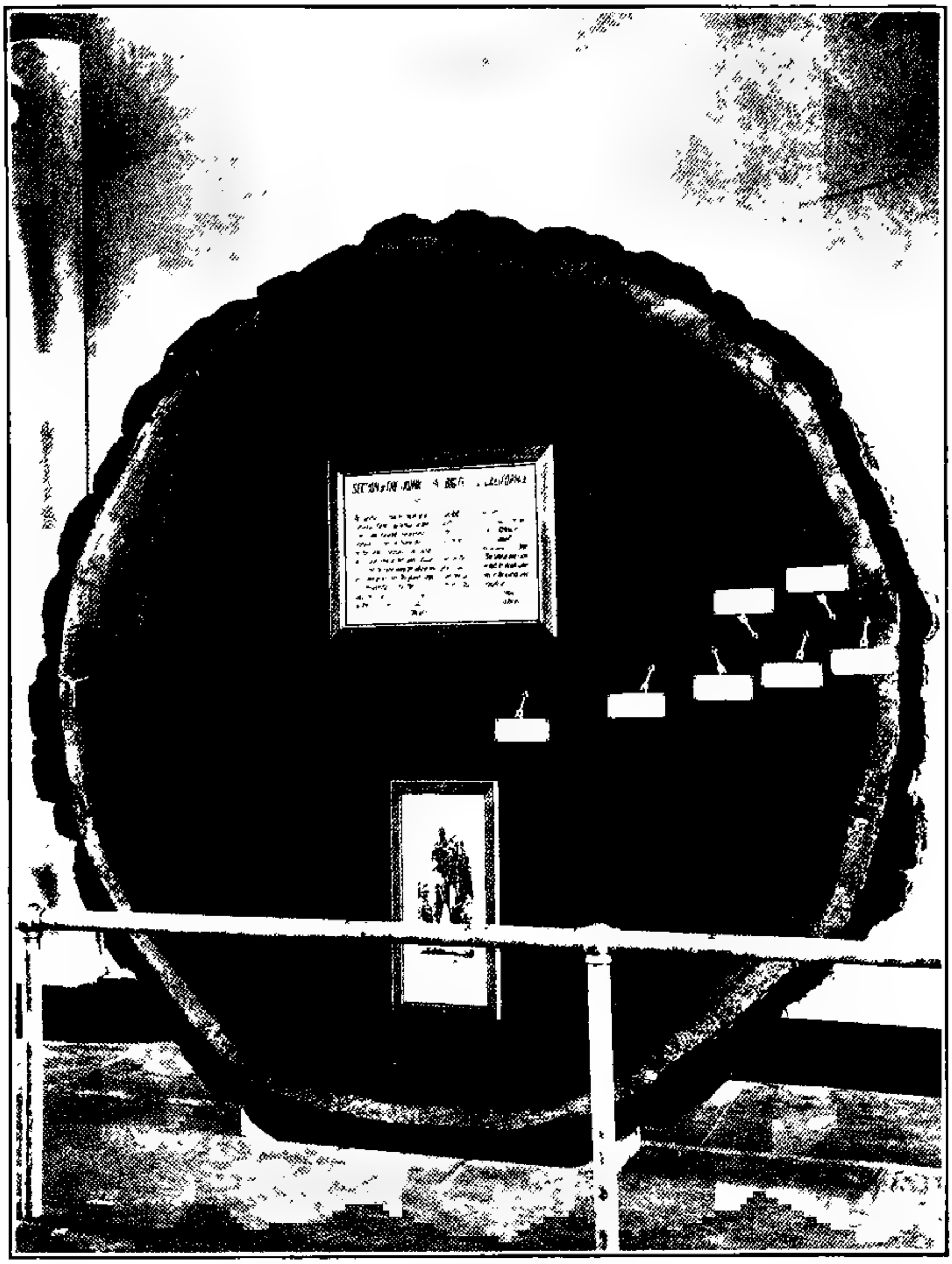

FIGURE 1. The "big tree" section, 1694 years old, as exhibited in the Museum Building of The New York Botanical Garden.

installed against the wall in the basement exhibit room of the museum building, where it is attracting much attention.

In view of the great age of the tree, it was possible to mark several of the growth rings with important dates in history.

Those selected were 400 A. D., the approximate time of the Roman evacuation of England, the tree then being 177 years old; 800, coronation of Charlemagne; 1066, Norman conquest of England; 1215, Magna Charta; 1492, discovery of America by Columbus; 1624, first settlement of New Amsterdam (New York); and 1776, Declaration of Independence.

The largest living specimen of *Sequoia gigantea,* the so-called General Sherman tree, is estimated to be between 4000 and 5000 years old, and has a maximum basal diameter of 37.3 feet; so the 10-foot section in the Museum of The New York Botanical Garden, although from a tree that thrived for 1694 years, is from a relatively small specimen. It is interesting to note that while this section at The New York Botanical Garden is considerably smaller than the one in the American Museum of Natural History, which has a diameter of 16 feet, yet it is from a tree 353 years older than the American Museum specimen. This illustrates the difficulty in accurately estimating the age of these large trees from dimensions alone, as different specimens, apparently even when growing in close proximity to each other, increased in size at different rates. In the specimen in The New York Botanical Garden Museum the growth from A. D. 223 to A. D. 279 was exceedingly rapid, the growth rings being wide and conspicuous. After that date growth was very slow, the average increment in trunk diameter per hundred years from about 280 A. D. to 1917 being between 6 and 7 inches, with a gradual tendency to increase in size more and more slowly as the tree attained greater age.

E. D. Merrill.

CONFERENCE NOTES FOR FEBRUARY AND MARCH

At the monthly conference of the Scientific Staff and Registered Students held on February 11th, Dr. John K. Small gave a report on "The Epiphytic Bromeliads of the Continental United States." The Bromeliad family is represented in the southeastern United States by eighteen species of epiphytes. These fall into five genera, *Dendropogon* (one species), *Diaphoranthema* (one species), *Tillandsia* (1 species), *Catopsis* (2 species), and *Guzmannia* (one species). Most of the species occur also in tropical America. Four species occur in two or more states, thirteen species occur only in Florida, two species are endemic in Florida, and one species is endemic in Texas. The geographic range, within the United States, extends from Florida to southern Texas and southern Virginia, mostly in the Coastal Plain.

Dr. Ernst J. Schreiner reported at this conference on "Hybrids between the Large-toothed Aspen (*Populus grandidentata*) and the Northern Necklace Poplar (*Populus balsamifera virginiana*)." These particular hybrids were obtained by using the Necklace Poplar as the seed parent. In general appearance the hybrids resemble the Aspen but in careful study numerous characters show influence of the seed parent. These hybrids are all of poor growth and very susceptible to a twig disease (*Fusicladium tremulae*).

At the conference for March (11 Mr), Mr. John Y. Keur made a progress report of his research at the Garden on "The Virus Diseases of Abutilons." A large collection of living plants was displayed, illustrating the various aspects of disease, the problems under investigation, and the evidence that is being obtained regarding the nature of the virus.

A. B. Stout,
Secretary of the Conference.

POPULAR COURSES IN BOTANY AT THE NEW YORK BOTANICAL GARDEN

There is no more agreeable way to study the plants than to go into their home surroundings in woodlands, meadow, and swamp and there study their habits and characteristics. The course of study, entitled "Plants and Their Home Environments," which

started with its first class exercise on Tuesday afternoon, September 15, at 4:10 P. M., aims to accomplish this very thing in a series of fifteen sessions of field trips and lectures. It is designed particularly for teachers and outdoor enthusiasts who wish to make themselves more proficient in the field of botany and to gain a more intimate knowledge of plant life. Each session will occupy approximately two hours and on fair-weather days will combine outdoor study with lectures and notes.

The course was originally designed to reach the alert requirements of the New York teachers and is accepted by the Board of Education as meeting this requirement. The fee for the course is $10.00 which includes membership in The New York Botanical Garden for one year. Those who are already members of the Garden will be admitted to this or any other equivalent course without additional charge.

Two other courses will be offered during the winter, one on "How to Grow Plants," beginning the first Saturday in December, and another on "Plant Relationships" beginning the 15th of February. These courses will be under the general supervision of Dr. Forman T. McLean, Supervisor of Public Education, The New York Botanical Garden.

A GLANCE AT CURRENT LITERATURE[1]

When gas from inside the trunk of a chestnut tree was lighted, it shot a long blue flame out into the air, in experiments recently conducted by C. A. Abell, of the United States Forest Service. In *The Forest Worker* for July he tells how he bored into trees with apparently unsound heartwood and procured this jet of flame. Water pressure proved to be similarly powerful. In a healthy scarlet oak tree during the dry season it threw a stream of liquid through the bore three or four feet out into the air.

* * * *

Color of flowers is not necessarily affected by the acidity of the soil, according to Rexford F. Daubenmire, of Butler University, Indianapolis. In a report issued by his university in August, he

[1] All publications mentioned here—and many others—are available in the library of The New York Botanical Garden in the Museum Building

shows that no relation existed between flower colors and soil content in Phlox, Tradescantia, Dodecatheon, Delphinium, Hepatica, and Lupinus which he studied.

* * * *

Wild white clover is the most successful pasture growth, especially where summer drought is liable to occur, E. Wyllie Fenton declares in the *Annals of Applied Biology* for August. Italian rye grass is also valuable, he says, with orchard grass (*Dactylis glomerata*) and rough-stalked meadow grass (*Poa trivialis*) as good additions. * * * *

The sensitive fern, *Onoclea sensibilis,* is said to be the only fern which is identical in the modern and fossil forms, according to the *American Fern Journal* for the summer quarter.

* * * *

To make the early spring garden gay with the tiniest blossoms, Marjorie Sulzer, in *Better Homes and Gardens* for October, recommends hoop-petticoat daffodils and lady tulips (the pink and ivory striped ones) especially, to be planted this month. For these, she says, have become her favorites, lately added to her usual spring collection of snowdrops, cloth-of-gold crocuses, squills, and glory-of-the-snow.

* * * *

A child's transition from innocence to knowledge is most easily and safely made in a garden, says Angelo Patri, also in the October number of *Better Homes and Gardens.* Give a child plenty of space in a sunlit corner, where he can actually grow things successfully himself, this great child psychologist advises, concluding: "Tilling the soil and raising a garden always serve a double purpose. Character grows while plants are tended."

* * * *

A protective and cleansing dressing for the hands, to be used while gardening, is described by Dr. E. A. Merritt in the *Garden Digest* for May. It is made by dissolving 95 grams of soap chips in 370 grams of distilled water, adding 20 grams of gum arabic and 2 grams of hydrous wool fat, and whipping until it congeals. Then add 6 minims of oil of lavender, and whip again.

* * * *

Autumn color in the rock garden is a phase to be sought for, and Helen Russell, in *Horticulture* for September 15, tells what

plants to use. She suggests first of all *Sedum Sieboldii, S. dasyphyllum*, and *S. lydium*, which turn pink, pink-purple, and crimson, respectively; then the houseleeks, *Sempervivum*, which also turn, except for *S. sarmentosum*, which is all the more attractive with its contrasting dress of green. To trail over the ledges, remaining red all winter, she would have *Euonymus radicans coloratus*, and for other showy features, the heathers and cotoneasters. Poppies, the arctic chrysanthemum, and *Daphne cneorum*, she mentions for their fine late flowers.

* * * *

The reprinting of volume one of Britton and Rose's *The Cactaceae* began with the appearance of the first sixteen pages in the September issue of the Journal of the Cactus and Succulent Society of America, which is undertaking the task.

CAROL H. WOODWARD.

NOTES, NEWS, AND COMMENT

Preliminary programs for the Sixth International Congress of Genetics, to be held at Ithaca, N. Y., August 24–31, 1932, have been distributed. The foreign delegates are expected to arrive in New York on August 20, and the extensive program for the New York entertainment of these delegates includes a visit to The New York Botanical Garden on August 22.

Mr. E. E. Hansen, of the University of Michigan, plans to sail for Bolivia on October 3rd to carry on field work in botany and zoölogy for a period of several months. His trip is being financed on a coöperative arrangement, contributions having been made by The New York Botanical Garden, the Arnold Arboretum, the University of Michigan, the University of California, and the United States National Museum to cover the expenses of the expedition. The New York Botanical Garden has been able to participate through the income from the C. B. Robinson Memorial Fund. After this item was in type, we learn that Mr. Hansen has postponed his departure until 1932.

Dr. Fred J. Seaver, curator of the fungi, recently spent several days in Ithaca attending a mycological foray given by the department of Plant Pathology of Cornell University. The guests of honor were E. W. Mason, Assistant Mycologist of the Imperial Bureau of Mycology, Kew, England, and Jacob E. Lange, the

well-known mycologist of Denmark. In addition to these, a number of well-known American mycologists were in attendance. The meetings consisted of field excursions and subsequent study and comparison of material collected. Dr. Lange made a special effort to correlate the American and European forms of the higher Basidiomycetes.

The following botanists enrolled in the library during the summer: Profs. A. Le Roy Andrews and H. H. Whetzel, Ithaca, N. Y.; Mr. George L. Slate, Geneva, N. Y.; Mr. C. H. Rogers, New Brunswick, N. J.; Miss E. L. Sturm, Mr. Paul W. Bowman, and Mr. W. W. Eggleston, Washington, D. C.; Mr. H. F. Williams, Durham, N. C.; Dr. A. M. Blizzard, Hartsville, S. C.; Prof. and Mrs. Alfred H Gilbert, Coral Gables, Fla.; Mr. P. H. Löding, Mobile, Ala.; Mr. George Thomas, New Orleans, La.; Prof. Frank T. McFarland, Lexington, Ky.; Prof. Willard N. Clute, Indianapolis, Ind.; Mr. Forest C. Strong and Mr. Karl Dressel, East Lansing, Mich.; Rev. Anselm M. Keefe, West Depere, Wis.; Dr. Myron P. Backus, Madison, Wis.; Prof. Shigeo Yamanouchi, Chicago, Ill.; Prof. Adriance S. Foster, Norman, Okla.; Prof. Henry S. Conard, Grinnell, Iowa; Mr. G. E. Osterhout, Windsor, Col.; Prof. T. H. Goodspeed, Berkeley, Cal.; Dr. M. B. Linford, Honolulu, Hawaii; and Mr. N. Fabritius Buchwald, Copenhagen, Denmark.

"The Gardens of the World" was the title of an illustrated lecture given by Colonel E. A. Havers at The New York Botanical Garden on September 19, 1931. The first picture presented was the "Garden of Eden," a beautiful scene on the banks of the Euphrates. The Garden of Gethsemane brought back pictures of Bible history; a trip into Africa showed an oasis of the Great Sahara, where everything can grow, owing to the rich soil and an abundance of water; Palermo's gardens without flowers were shown; also Villa Palmieri and Villa Boccaccio—charming scenes of Monte Carlo, followed by the alpine flowers with their marvelous beauty; Holland, the land of the bulbs, miles and miles of bloom and perfume; the gardens of the poets, including that of Shakespeare and Ann Hathaway; the gardens of Windsor Castle, and many more of the royalty, also the Temple Gardens and Kew

Gardens; Earl of Kenmare's Irish Gardens, with statuary and Italian gardens and cool sylvan courts; poppies in the Arctic regions; wonders of the Rockies, American gardens, both cultivated and wild, the cacti and the modernistic home, a gorgeous pageant of color at the bottom of the sea, strange trees in the West Indies, blue bells in the volcanic ashes, night-blooming cereus in Hawaii, gardens of the headmen in New Guinea jungles; Japan with its cherry blossoms and other glorious flowers.

On August 22, 1931, Professor F. A. Varrelman, of the American University, Washington, D. C., gave an illustrated lecture at the Botanical Garden on "Seedless Fruits." Seedlessness in fruits, Professor Varrelman stated, is often due to lack of pollination, a condition which, paradoxically, may often in the same or different species produce excessive seed and fruit formation, or numerous embryos within a seed. Fruit development without pollination is called parthenocarpy. Seed development without fertilization is known as parthenogenesis, and the formation of numerous embryos in a seed is polyembryony. Seedlessness may be caused also by stimulation, the stimulus being an insect, or by pollination, in which case, however, the seeds are aborted early and fruit development takes place anyway. Many plants exhibiting these conditions seem to occur in related groups. Among the Malvales we find seedlessness in mulberries, figs, breadfruits, oranges, lemons, grapefruits, and touch-me-nots; in the Rosales in strawberries, apples, pears, cherries, gooseberries, and pitless plums; in the Myrtales in guavas and pomegranates; in the Loasales in cucumbers, melons, and prickly pears; in the Iridales in the pineapples and bananas. Other types, of different classifications, are barberries, tropical pawpaws (papayas), poplars, nightshades, tomatoes, grapes, chestnuts, pistacio nuts, and dates.

On Saturday afternoon, July 25, Dr. Fred J. Seaver, Curator, gave an illustrated lecture at The New York Botanical Garden on "Edible and Poisonous Mushrooms." Our entire knowledge of plants, said Dr. Seaver, came about originally in response to the desire on the part of man to use them as food or medicine. This is true of the fungi as well as other forms of plant life. For thousands of years fungi have been used as articles of diet. The

matter of so using them would be a very simple one were it not for the fact that a few species, and comparatively few, are deadly poisonous. The general public is always interested in having some "fool-proof" rule by which the edible can be distinguished from the poisonous forms. One of the questions with which the botanist is most frequently confronted is how to distinguish between the "mushroom" and a "toadstool." To the botanist there is no difference, a mushroom is an edible toadstool or a toadstool is a poisonous mushroom, whichever way you may prefer to say it. The botanist refers to them as edible and poisonous mushrooms. There is no infallible rule by which the good can be distinguished from the bad forms. One must learn to know them as you learn to know your friends or your enemies. Unless one is thoroughly familiar with the species with which he is dealing it is absolutely unsafe to attempt to use it as an article of food.

Meteorology for September. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 90° F. on the 2nd; *100° on the 11th;* 93° on the 14th; and 94° on the 22nd. The minimum temperatures recorded were: 51° on the 7th; 54° on the 8th; 55° on the 19th; 47° on the 25th; and *45° on the 29th.* The total precipitation for the month was 1.60 inches.

ACCESSIONS

LIBRARY ACCESSIONS, DECEMBER 1, 1930–FEBRUARY 28, 1931

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Vol. I. An Annotated Catalogue of the Flora of Montana and the Yellowstone Park, by Per Axel Rydberg. ix + 492 pp., with detailed map. 1900.

Vol. II. The Influence of Light and Darkness upon Growth and Development, by D. T. MacDougal. xvi + 320 pp., with 176 figures. 1903.

Vol. III. Studies of Cretaceous Coniferous Remains from Kreischerville, New York, by A. Hollick and E. C. Jeffrey. xiii + 138 pp., with 29 plates. 1909.

Vol. IV. Effects of the Rays of Radium on Plants, by Charles Stuart Gager. viii + 478 pp., with 73 figures and 14 plates. 1908.

Vol. V. Flora of the Vicinity of New York: A Contribution to Plant Geography, by Norman Taylor. vi + 683 pp., with 9 plates. 1915.

Vol. VI. Papers presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii + 594 pp., with 43 plates and many text figures. 1916.

Vol. VII. Includes New Myxophyceae from Porto Rico, by N. L. Gardner; The Flower Behavior of Avocados, by A. B. Stout; Descriptions of New Genera and Species of Plants Collected on the Mulford Biological Exploration of the Amazon Valley, 1921–1922, by H. H. Rusby; and The Flora of the Saint Eugene Silts, Kootenay Valley, British Columbia, by Arthur Hollick. viii + 464 pp., with 47 plates, 10 charts, and 11 text-figures. 1927.

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Bronx Park, New York, N. Y.

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Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

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Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

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THE RUDOLPH BLOCK COLLECTION OF WALKING STICKS
SAMUEL J. RECORD

CELESTIAL LILIES
JOHN K. SMALL

A GLANCE AT CURRENT LITERATURE
CAROL H. WOODWARD

THE BARTLETT-NORCROSS GREENLAND EXPEDITION

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ACCESSIONS

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THE RUDOLPH BLOCK COLLECTION OF WALKING STICKS

The New York Botanical Garden has recently placed on exhibit the Rudolph Block collection of walking sticks. It is on loan from the collector and owner and comes from the United States National Museum in Washington, where it has been on display for three years. The exhibit fills ten large cases, each containing 140 sticks.

Fourteen hundred canes! Why, if the owner chose to carry a different stick every day it would require nearly four years to use them all! But not one of these sticks has ever been carried by the owner and, though substantially made, they were never intended for service. In his own words, "This is primarily a collection of the interesting woods of the world. The selection of walking sticks as a medium for presenting the varieties and beauties of these woods is a secondary feature. Where two or more specimens of the same wood find a place in the collection it is only because of some idiosyncrasy of color, figure, or other quality that is characteristic of the varieties of this wood."

In reality, then, this is not an assembly of canes, but a collection of woods. More than that, it is a scientific collection, and it was my task to see that each wood was determined with as high a degree of accuracy as was possible under the circumstances. Every stick is a museum specimen and among the fourteen hundred are representatives of 950 named species and about 550 different genera. There were eleven that I could not identify and sixteen that I could only refer to their families.

These woods have been gathered from far and near and represent the important forest regions of both hemispheres. Some

FIGURE 1.—The Rudolph Block collection of walking sticks, as recently exhibited in the Smithsonian Institution, United States National Museum, Washington, D. C. (Photograph reproduced by courtesy of the Secretary of the Smithsonian Institution.)

came from timber dealers, but a great many more have never found their way into commercial channels and have been supplied by foresters, explorers, and scientific institutions, as well as "friends, acquaintances, and random correspondents in all parts of the world." In fact, so much and such widespread interest was shown in this unique undertaking that Mr. Block came to feel that his relationship to the collection involved more than private ownership. It was to fulfill this obligation to the public that he has made these beautiful objects available to inspection.

It should be borne in mind that almost without exception every stick was obtained in crude form. The canes and handles were fashioned by experts from designs prepared by Mr. Block. One might suppose that it would take the greater part of a lifetime to get all these materials together, but as a matter of fact it was all done in less than four years. The first catalogue was printed early in 1925 and describes 200 sticks. A second catalogue appeared a little more than a year later and lists 700. The present catalogue appeared in 1928 at the time the collection was placed on exhibit at the National Museum.

It should be no occasion for surprise to learn that the person who accomplished all this in so brief a space is a newspaper man of 40 years' experience in a profession in which distance means little and time means much. His success was the result of enthusiasm coupled with efficiency of organization. He sought out the most likely sources of supply, the best cane-makers, the most competent artisans in wood, metal, stone, and leather in this country and in Europe. Once started, there was an uninterrupted flow of materials and specimens, with every detail under his direct supervision.

In the fashioning of the sticks and handles, the bringing together of far-flung fragments of the vegetable, mineral, and animal kingdoms, he found a new medium for artistic expression that has resulted in veritable works of art. In all of this he did not lose sight of the fact that a beautiful wood is a natural masterpiece for which the most he could do was to provide an appropriate setting.

My personal acquaintance with Mr. Block began shortly after he began his collecting, although I had long known him as a writer of fiction and articles under his pen name of Bruno Les-

sing. His undertaking appealed to me and I willingly undertook to determine the specimens, though realizing that the task was by no means a simple one. Foresters and others who sent in woods were urged to supply the correct botanical names or provide herbarium material in cases of doubt. Particularly difficult problems in identification were submitted to specialists who could make comparison with authentic samples. In several instances the investigations served to fix for the first time the botanical status of some of the best known commercial timbers, and some species new to science were discovered.

It is no exaggeration to say that a large book could be written about this collection without exhausting the subject. Within it is practically the entire range of variation in wood. There are the heaviest kinds known—Lignum-vitae, Quebracho, Snakewood, and Palo Diablo—which are from a fourth to a third denser than water—and there are also the featherweights of the wood world, such as Balsa and Barriguda. How many persons realize that the substance of the lightest is the same as that of the heaviest and that the differences in density are due to compactness? Balsa, whose name (meaning raft) implies buoyancy, would sink in water like a stone were it not for the air imprisoned in its thin-walled cells.

Of the colors there is the milky white of Holly and jet black of some of the Ebonies; also pink, red, orange, yellow, brown, purple, and all sorts of intermediates and variegations. But one may search in vain for a true green or a true blue, because woods of these natural colors are not known to exist. Certain fungi can impart new colors to woods, and it is not uncommon to find beautifully green-stained pieces of Oak and Ash, pink-streaked Box-elder, and blue-stained Pine. In some woods the colors deepen and improve with age, in others they fade or become dull and unattractive. One of the most striking of all is Purpleheart, but that royal color is not found in the timber of a living tree, and years may be required for it to permeate even so slender a stick as a cane. No one has yet solved the mystery of variegated and mottled woods, though some are undoubtedly due to injuries and disease. No adequate explanation has ever been offered for the letter-like spots on Snakewood or the peculiar markings of mottled Ebony.

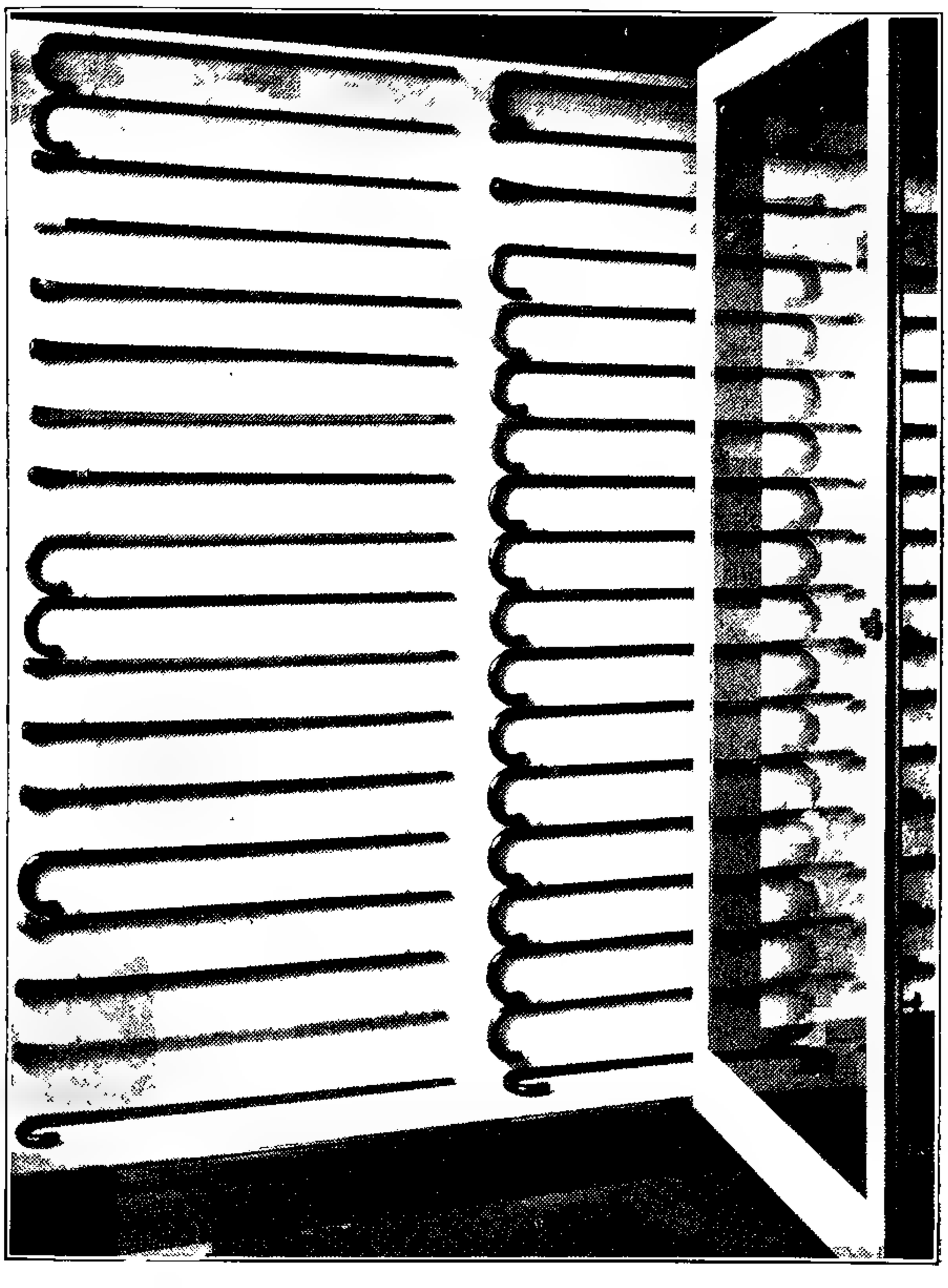

FIGURE 2. A part of the Rudolph Block collection of walking sticks, as now displayed in the Museum Building of The New York Botanical Garden.

There are several dyewoods in the collection, such as the African Camwood and tropical American Brazilwood, Brasilette, and Logwood. Brazilwood is not so named because it comes from Brazil; on the contrary, that great South American country took its name from the wood! Logwood at one time in its history proved more efficaceous than the Bible in making honorable men out of pirates! That was some 300 years ago when freebooters infesting the Honduras coast discovered more profit in cutting Logwood than in plundering ships. Old North Church in Boston was completed out of the proceeds of a schooner-load of Logwood sent from Honduras about 1750. As one writer puts it, "Paul Revere might have had no steeple on which to have his lanterns hung in 1775, had it not been for these loyal, hard-working pioneers of the Bay Islands, off Puerto Castella, who sent back their wealth of Logwood to the mother church in the Old North End, Boston."

Another wood with an odd history is Lignum-vitae. It was probably the first timber from the New World to attain commercial importance in Europe. It was called the Wood of Life because its resin was credited with almost miraculous power to cure the worst diseases of mankind. Many learned books were written about it and for 200 years it commanded the highest esteem of the medical profession. And then science came in and robbed it of its one remedial ingredient faith! Today the peculiar tang of the resin may be tasted in a few proprietary medicines and that is all that remains of the claim to the title of the Wood of Life. The timber has a more legitimate use, for the propeller shafts of every steamship turn on bearings of Lignum-vitae, which supply their own lubricant—the once miraculous resin.

There are two chieftain woods in the collection—the Pink Ivory of Zululand and the Bloodwood Cacique of Panama. Mr. Block's attention was attracted to the first of these by a casual reference in Professor Boulger's book on timbers to "the as yet undetermined Pink Ivory, a singularly beautiful wood." His first efforts to obtain a specimen were unsuccessful and he was told that the tree was so scarce that it had not been possible to find one to make a cane for the Prince of Wales upon the occasion of his Royal Highness' visit to South Africa. Mr. Block, however, found ways of getting not one but several sticks and there are three in his col-

lection. To quote from my article in *Tropical Woods* (March 1, 1928): "This wood has always been prized by the Zulus and their kindred, such as the Swazis. Under the old tribal custom, which still prevails in the interior, the trees were not allowed to be cut. Formerly only the head of the royal house was entitled to carry a stick of it and infringement of this prerogative was punishable by death. The Zulu king, Dingaan, whose defeat by the emigrant Boers in the early forties is still celebrated in South Africa by a national holiday, always carried an 'assegai' (spear) hafted with this wood. It is said that he killed his own mother with this spear, and, after his defeat, he was himself killed with it, at his own desire, by his henchmen."

The wood of Bloodwood Cacique, as known to the Indians of Panama, is not obtained from living trees, but from fragments of old trunks partially or completely buried in the rotting forest litter. It is believed to have both medicinal and supernatural properties and has long been the favorite remedy of the tribal medicine man. A small chip applied to a wound is said to relieve the pain and stop the bleeding, while a piece placed behind the ear will cure a headache. The old chiefs used the wood as a symbol of office and authority and carved many strange designs from the chunks that had defied the ravages of decay in the dank jungle.

There is the Cedar of Lebanon, with its reminder of King Solomon's glory. The Cypress of Palestine, employed by the ancient Egyptians for mummy cases and by the Roman Church for the coffins of the popes, and likewise used for the gates of Constantinople, which remained sound for 1100 years until destroyed by the Turks in 1453. Boxwood from the Caucasus, the only material suitable for fine wood engravings, is of the same kind as that upon which the prophet Isaiah published his admonitory message and of which was made the yoke for Priam's steeds. There is the Yew, "obedient to the bender's will" (Spenser), which because of its combined toughness and resilience has been prized for bows from times immemorial.

One of the strangest forms of wood is found in burls, those peculiar swellings which arise on trees as a result of a thousand buds trying to grow in the normal space for one. Mr. Block employed many kinds in making handles, and in the descriptions one

finds references to Amboyna, Lilac, Thuya, Redwood, Satinwood, Ash, Walnut, Myrtle, Wild Cherry, Comino, and Manzanita. Then there are the ornate distortions of grain from crotches where the growth of branches, acting like a giant nutcracker, has squeezed the wood between them. There are also many other forms of grain—curly, wavy, ribbon, and that peculiar sort called bird's-eye. One very unusual structure appears as a small inlay in a stick of Cuban Acana (No. 842). It is a cross section of Cipo Cruz (Vine of the Cross), with the pith showing as a per fect cross.

Such are just a few of the many features of this unusual collection. The casual visitor may ask, "Why so many canes?" and his eye may soon tire from trying to comprehend them all. But to those who can devote the time to study these beautiful specimens, they provide an endless source of instruction and enjoyment.

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CELESTIAL LILIES

In a note in which the rescue of Bartram's *Ixia coelestina* and the placing of it in its proper pigeon-hole were recorded, reference was made to further trouble that was gradually appearing in the same group of iridaceous plants.

Thomas Nuttall, who is generally clear in his interpretation of plants, made a most astonishing mixture of morphology and geography when he proposed and described his genus *Nemastylis,* which, to be technically correct, should have been spelled *Nematostylis.* Nuttall's generic description, in which he proposed the genus *Nemastylis,*[1] covers the technical characters of the second species he refers to it, namely, *N. geminiflora,* which is there proposed as a new species.

However, the first species referred to his newly proposed genus is *Nemastylis coelestina,* founded directly and definitely on Bartram's *Ixia coelestina,* a plant discovered by Bartram in the flatwoods of northern Florida. In the abbreviated description of *Nemastylis coelestina,* Nuttall contradicts the technical stigma

[1] Trans. Am. Phil. Soc. (II) 5: 157. 1833–37.

character of the genus, with "stigmatibus brevibus" against "stigmata filiformia." In the detailed specific description he again makes a contradiction, with "stigmas three" against "stigmata sex."

Now, *Ixia coelestina* was described from plants growing in Florida, and no other geographic range was claimed for it when it was launched as a species. In addition, a good figure, which Nuttall says, "appears to be very accurate," shows the essential organs of the "*Ixia*" to be very different from those on which the genus *Nemastylis* was founded and which also are very different from those definitely described by Nuttall, or seen by him in any iridaceous plant growing in the lower Mississippi watershed. Yet, Nuttall records for the geographic distribution of *Nemastylis coelestina* (*Ixia coelestina*, a plant then definitely known only from the flatwoods of northeastern Florida): "In the hilly prairies of the Arkansas territory, betwixt the sources of the Pottoe of Arkansas and the Kiamesha of the Red river. First found in *South Carolina* [the italics are ours] by William Bartram, whose figure appears to be very accurate."

Recently, the status and general geographic distribution of Bartram's *Ixia* have been quite definitely settled.[2] In a general way we understand Nuttall's *Nemastylis*. We say in a general way, for the plants, whether they be the true *Nemastylis* of Nuttall or other undescribed species, have been masquerading under several other generic names for nearly a century! In our studies of the western *Nemastylis* and of the related genus *Eustylis*, we have been greatly aided by Caroline Dormon, of Chestnut, Louisiana, through notes, drawings, photographs, and specimens.

Thomas Nuttall's first reference to what was later to be described as *Nemastylis* was in an account of his travels into the Arkansas territory in 1819.[3] On page 144 of the work cited he records that:

"Today, accompanied by Doctor Russel, and another gentleman of the fort [Fort Smith], I rode to Cedar Prairie, lying about 10 miles south-east of the garrison, and presenting an irregular undulating surface. I here found a second species of that interesting plant, which my venerable friend, William Bartram, called

[2] Jour. N. Y. Bot. Garden **32**: 155–161. 1931.

[3] A Journal of Travels into the Arkansas territory during the year 1819. (Published in 1821.)

Ixia coelestina; the flowers of this species are also of a beautiful blue, and white at the base."

In the following year (1822) William Barton published and figured *Ixia acuta*. After a description he continues:

"Grows in the Arkansa Territory, whence roots were brought by Mr. Nuttall. The specimen from which the drawing was made, flowered this summer at the Botanic Garden of Kingsess. The second flower bloomed on the twelfth of May, and by the politeness of Col. Carr, the proprietor, an opportunity was afforded me of figuring it during the very short time it continued in bloom. So very evanescent is the caerulean hue of this flower, that it faded perceptibly in thirty minutes, and so transitory was its bloom that in the lapse of little more than an hour, its petals became convoluted, and the flower folded up. The anthers became involuted immediately after the discharge of pollen, which soon occurred when the flower expanded."[4]

This *Ixia acuta* was rechristened *Nemastylis acuta* by Herbert about thirty years later.

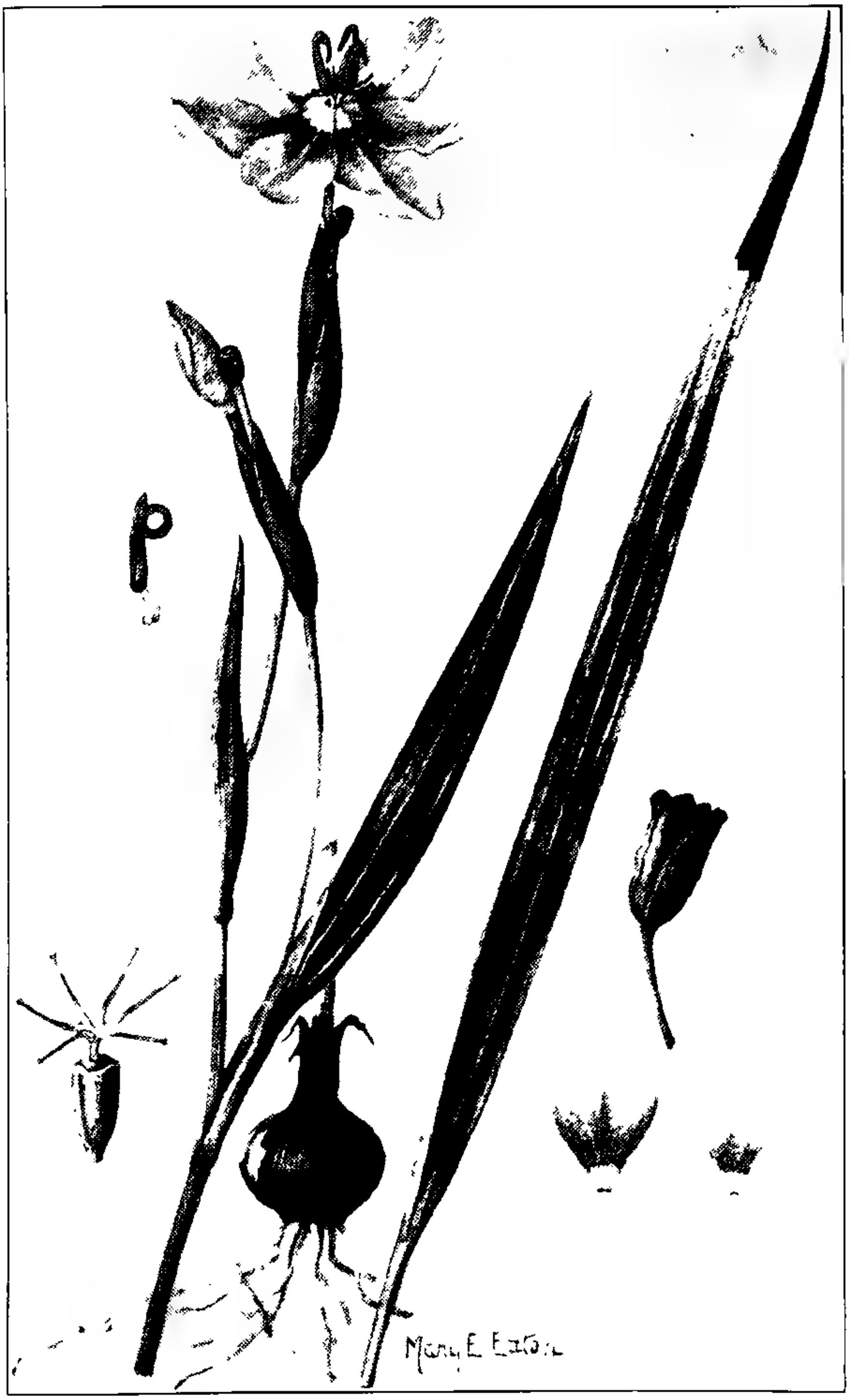
Bad geography continued to haunt *Nemastylis*. In a note published in a European plant periodical[5] one may find a fairly good colored figure of *Nemastylis geminiflora* (*N. acuta*) and a few lines of descriptive matter in which reference is made to "cette magnifique Iridée Californienne." Of course, the geography is an error. It may be that the writer of the note was isolated in Europe and considered North America west of the Mississippi River to be California, or it may be that the material in question was at one time taken from the native region of *Nemastylis* in the south-central states to California and later sent to Belgium, where the note in question was published.

By referring to the July number of this JOURNAL[6] it may be seen at the end of a note on Bartram's *Ixia coelestina,* that,

"Coincident with the solution of the status of the Bartram plant, the existence of a new species of *Nemastylis,* a genus typical of the Louisiana, Texas, Oklahoma, Arkansas region, native in Flor-

[4] Flora N. A. **2**: 90–91. 1822.
[5] Flore des Serres et des Jardins de d'Europe **21**: 45, pl. 2171. 1875.
[6] Jour. N. Y. Bot. Gard. **32**: 155–161. 1931.

FIGURE 1. *Nemastylis acuta.* A painting from plants collected on dry clay hills near Ashland, Louisiana. (Picture on opposite page.)


Mary E. Eaton

ida, was established. The long-known species of *Nemastylis* are spring-flowering plants. All evidence at hand indicates that the Florida species is fall-flowering. It is hoped that opportunity to study this plant in the field will be forthcoming this fall."

The opportunity apparently was not forthcoming, but it was made! The information gained in the field is recorded in the following paragraphs.

About thirty-five years ago A. H. Curtiss made a distribution of herbarium specimens collected mainly in Florida.[7]

These specimens were widely distributed, but scarcely any one at their destinations knew much about the flora and floristics of Florida.

Among these specimens was a plant erroneously determined as *Pleea tenuifolia* (number 5771). How this misnomer occurred it is hard to imagine, for the plant bears no resemblance to the genus *Pleea* whatsoever. This clue, however, has been in mind for many years, but the opportunity to solve the problem was not possible until this year, as indicated above.

During our campaign last June for clearing up the mysteries of Bartram's *Ixia,* we made a preliminary beginning on the solution of the Florida *Nemastylis* mysteries. The Curtiss specimen referred to above was collected September 18, 1896, a very unusual date for a *Nemastylis* to be in flower, in "Wet ground, Eau Gallie, Indian River, Florida." The first step in this solution was a specimen evidently of the same species as the Curtiss plant, collected along the marshes of the Saint Johns River prairie west of Indian River City by Professor Erdman West, of the University of Florida, on September 24, 1927. The second step was to make certain the plant was not a spring bloomer by visiting Professor West's station in June while we were working on the *Ixia* problem. Our search gave negative results. The third step was to have scouts on the look-out for the plant in September during their peregrinations anywhere in the low country west of the eastern coastal ridge from Eau Gallie, the Curtiss station, to Indian River City, the West station. The fourth step was to clear up the plant's status as a species and its particular and peculiar habits and habitats.

[7] Curtiss' Second Distribution of Plants of the Southern United States.

On September fourteenth we received the following telegram from Richard P Lord, of Gainesville, who helped much in solving the Bartram *Ixia* problem last June: "Have found *Nemastylis* in several new localities in sufficient quantity for study and photography. It is at height of season now."

September seventeenth found the writer in Gainesville, Florida, ready for field-work. Richard Lord, who had furnished the motive power for the *Ixia* campaign, had transferred his activities several days previous to our arrival from Gainesville to the Malabar-Melbourne region, over two hundred miles from Gainesville down the eastern coast of Florida. Mr. Lord had promptly located the plant in question back of Malabar, Professor E. L. Lord had recently discovered it on Merritt's Island, Professor West, as mentioned above, had collected it west of Indian River City, and Richard Lord had seen it west of New Smyrna. At all four localities it was noticed to open its flowers in the afternoon only. Based upon this peculiar habit we set aside two days to clear up everything connected with the fourth step mentioned above.

Professor West offered his services and motor for the field-work. Consequently we set out from Gainesville early Friday morning, September eighteenth, for the Malabar-Melbourne region, where we were met by Richard Lord. The first locality selected for observation was that on Merritt's Island. Crossing the Indian River at Cocoa we soon located a station for the plant in a wet hammock. The time was four o'clock in the afternoon and the flowers were just beginning to open their perianths. These envelopes may open gradually or with a burst of color. The habitat, wet hammock, may be considered swamp. Several miles further north on the island we found the plant growing in marshy places. We then drove back to Malabar, and in the low country west of the settlement found the flowers of the *Nemastylis* plants closed or closing at six o'clock. This locality may be described as flatwoods. As it was of no advantage to visit the more northern *Nemastylis* localities earlier than afternoon, we spent the following forenoon trying to locate *Nemastylis* southward, between Malabar and Vero. We were unsuccessful, especially, we assume, because we could not get far enough west into the lower country.

At Vero we visited the tropical-plant reservation being developed there in a primeval hammock and surrounding marshes for the education of visitors as to such vegetation, by Arthur A. McKee and Waldo E. Sexton. Would that more public-spirited men would have as much foresight!

These activities took us well into the hours of the afternoon and we were fifty miles from our Indian River City locality. However, we reached the colonies of *Nemastylis* just as the flowers were opening, about four o'clock. This locality may be described as marshlands bordering the Saint Johns River prairies. Having completed our observation here, we set out for the New Smyrna locality, forty-five miles still further northward. This region was reached about six o'clock. There, in several colonies, scarcely a wide-open perianth could be found. The flowers were closed or rapidly closing. There the habitat may be described as marshlands about cypress heads and swamps.

At this point we completed the two days set aside for the campaign and did not try to trace the plant further northward. The fifth step of interest in connection with this unusually interesting plant is to delimit its geographic range and to determine its floristics. Both of these are doubtless much more extensive than we now realize. The late daily flowering of this plant and the short diurnal period have successfully hidden its habits and its geography; just as the early daily flowering and short diurnal period did with its generic relative *Salpingostylis,* whose geographic range is not yet delimited.

Further information has been furnished by Richard Lord, who writes under date of October 11:

> "I am enclosing ripe fruits of *Nemastylis* so that you may get correct measurements of the pods and seeds. There are still remaining a large number of plants in which the first bloom is just opening. In colonies recently examined the earliest daily opening of the flowers was found to be a few minutes before three o'clock in the afternoon."

This undescribed species of *Nemastylis* may be named and described as in the appended foot-note.[8]

[8] **Nemastylis floridana** Small, sp. nov. Bulb ovoid to subglobose with a short neck, mostly 1–2 cm. in diameter, with brown scales; basal leaves ensiform, with sheathing bases and linear-attenuate plicate

FIGURE 2. *Nemastylis floridana,* growing in the jungle in a swamp on Merritt's Island, Florida.

Here two additional chapters, so to speak, suggest themselves, one of particulars, the other of generalities:

I. The previously known *Nemastylis, N. acuta* (*N. geminiflora*) of the lower Mississippi basin, whether it now comprises really only one species or more than one, has developed its flowering season in the spring. This habit applies also in the cases of the related genera of the lower Mississippi basin, *Eustylis* and *Herbertia,* and its geographic associate *Salpingostylis.* On the other hand, *Nemastylis floridana,* for some reason not apparent, has developed an autumn flowering season. The daily flowering period of *Nemastylis acuta* and the species of the associated genera mentioned above is in the early forenoon; that of *Nemastylis floridana* is in the late afternoon. In addition, the habitats of the western species of *Nemastylis* are clay hills and prairies; those of the eastern species are swamps, marshes, and flatwoods. An additional difference is found in the stature of the plants in question: that of the western plant commonly varies from 1.5 to 3.5 dm., while that of the eastern plant ranges from 5 to 15 dm.

Thus, the seasonal and daily routine of the two plants and the habitats represent opposites in time and in location.

About the only thing common to the two plants in question, aside from the terminal horizontal actinomorphic flower, are the technical generic characters, the thread-like style-branches and the curling anthers.

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blades; stem erect, mostly 4–15 dm. tall, glaucous, slender, simple or sparingly branched above, the branches spreading-ascending, each ending in a narrow, acuminate spathe with close-fitting bracts: lower stem-leaf or -leaves nearly similar to the basal leaves, up to 8 dm. long, the blades with two major lateral plications and minor ones between; perianth 3–5 cm. wide, violet, except the small white eye, about which are several black-violet glandular flecks: sepals elliptic to elliptic-obovate, obtuse: petals elliptic, slightly smaller than the sepals: stamens nearly erect; filaments very short, united to near the top, the tube about 2 mm. long; anthers nearly linear or slightly tapering, 8–9 mm. long, yellow, incurved and violet after the pollen is discharged; style very short, about as long as the filament-tube, the branches slender-subulate, spreading at right-angles to the style body, 4–6 mm. long, yellow at the base, thence magenta to the tip, the obscurely tufted stigmas very dark: capsule obovoid, about 1 cm. long, each with a 3-lobed cap-like top; seeds 1.5–2 mm. in diameter.—Swamps, marshes, and flatwoods, upper eastern coastal region of Florida, especially from Malabar to New Smyrna.

II. The definite determination of a species of the genus *Nemastylis* in the Atlantic coastal region of Florida, coincident with the record of the botanical rediscovery and proper interpretation of Bartram's *Ixia coelestina,* is of interest from different angles: (a) as specific representatives of small genera now isolated on different sides of the Gulf of Mexico; (b) as plants having taken up their abode in quite different regions (environments), maintaining constant characters in the structure and functions of the essential organs of the flowers; (c) as representing remnant species of a genus once more homogeneous and of a wider geographic distribution, which includes the apparently unanswerable question why two species closely related technically and derived from ancestors, perhaps a common ancestor, in the ancient highlands, should take on diametrically opposite characteristics while one migrated to the southeast and the other to the southwest; (d) as to how a genus may be confined to a limited latitudinal distribution which extends little northward, and southward, like some of its relatives, blocked by the Gulf Stream on the one hand and by the Rio Grande on the other, although furnished with the means of dispersal by an abundance of seeds produced annually and by protection from fire and freezing by deep-seated bulbs.

The writer will be glad to receive reports of discoveries of the Florida *Nemastylis* from stations outside the geographic limits recorded above, and especially glad to receive bulbs of *Nemastylis* and of any related bulbous iridaceous plants from Louisiana, Texas, Oklahoma, and Arkansas, in order to grow, study, and figure the plants. The attempt to study and interpret these plants from herbarium specimens, either specifically or generically, in the past, resulted in a miserable hodge-podge—nothing short of a botanical farce—whether attempted by botanists in Europe or in America.

JOHN K. SMALL.

A GLANCE AT CURRENT LITERATURE[1]

Cinchona bark, the source of quinine, has been dispersing fevers since 1630. The proceedings of the three hundredth anniversary celebration of the first recorded use of the bark, which have just arrived at The New York Botanical Garden Library from the Missouri Botanical Garden in St. Louis, reveal romantic tales about this most important drug. One legend about its discovery is that some cinchona trees blew into a pool in Peru and rendered the water too bitter to drink. One native, however, suffering from a fever, found this pool the only one from which to quench his burning thirst. He drank abundantly, and his fever disappeared. For nearly two hundred years the bark was used with little knowledge of its constituents. Two pharmacists, Pelletier and Caventou, first isolated quinine from it in 1820. For many years Peru was the only country cultivating cinchona trees, but exploitation eventually robbed the country of its groves. Now 97 per cent of the world's supply comes from Java, where it has been cultivated under the Netherlands government control since 1852.

* * * *

Most of the country's supply of fuller's teasel is grown in central New York, according to an article in the October *Flower Grower,* culled from *Special Crops.* The cultivated species has hooks so strong that the bur must be used under water in raising the nap on woolen materials, to keep from tearing the cloth. The hooks are finer than any that can be made of steel.

Though the berries of some sumacs are used as a food in Japan, the very leaves of other species are poisonous to the touch. The story of sumac and its near relative, poison ivy, is told by Horatio C. Wood, Jr., in volume six of *Popular Science Talks.* Poison sumac, points out the author, is best identified by its smooth-edged leaflets, by the small clusters of dirty-greenish-yellow berries growing in the axils of the leaves, and by its swampy habitat. All other sumacs are harmless. Poison ivy is distinguished by its three leaflets and the varnished appearance of their

[1] All publications mentioned here—and many others—are available in the library of The New York Botanical Garden, in the Museum Building.

surface. It is, in fact, a near relative of these two plants from which is derived Japanese lacquer. Of the poison contained in the ivy, little is actually known, though a number of cures are used successfully. Among them the author recommends chiefly soap, alcohol, epsom salts, certain metal salts, or phenol, applied with caution that the wash does not run over uninfected parts of the skin.

* * * *

A study of fossils as "living plants in a real world," is the characterization given by *Nature* for October 3, of A. C. Seward's "Plant Life Through the Ages: A Geological and Botanical Retrospect," recently published at Cambridge. This British magazine reviews the book at great length. The volume, which follows several other studies of fossils by the same author, gives a geological background for the study of plants through every stage of their evolution.

* * * *

Four beautifully colored prints of four species of *Echinocactus* are contained in "Blühende Sukkulenten," recently received by The New York Botanical Garden. Descriptions accompany the plates.

* * * *

A penthouse garden which was exhibited at the Trenton Fall Flower Show is pictured in the *Florists Exchange* for October 10. Pink begonias, ageratum, coleus, and rare succulents were used in the planting, with aquatic plants growing in a brick-edged pool.

* * * *

Dish gardens, in which unique "scenic" effects are produced in miniature through the clever arrangement of small plants and porcelain figures, are described in *Nature Magazine* for October. Patten Beard, the author, tells of the best plants to use in this manner, and how to treat them.

* * * *

Londoners are lucky folk, for they are now getting freshly picked mangoes, most delicate and delicious of fruits, shipped by airplane direct from Egypt. This is only one of many delectable products of the tropics which travel and transportation are bringing nearer to the consumer of the temperate zone. Among them, according to T. Ralph Robinson, of the United States Department

of Agriculture, in an address reported in the October 1 news letter of the Division of Horticultural Crops and Diseases, are the Japanese persimmon, the pawpaw, or papaya, the cherimoya, white sapota, sapodilla, avocado, and pomegranate, all now being grown in the United States. Less familiar, but said to be no less delicious, are the mangosteen, durian, coriman, canistol, loquat, feijoa, Surinam cherry, grumichama, Natal plum, carambola, jaboticaba, granadilla, and the lychee.

* * * *

Parchment shades on electric lights hidden among the greenery have produced a moonlit garden for Walter Raleigh every summer evening. In the August issue of the *Home Acres and Countryside Magazine* he tells how he arranged his artificial moonlight.

* * * *

Peach-tree borers have been most successfully killed in Missouri, according to the *Missouri Botanical Garden Bulletin* for September, by gas from paradichlorobenzene. The trunks of the trees were exposed to the gas in the fall when the eggs were hatched and the young were just entering the trees. This treatment had to be lessened or avoided on trees under six years of age.

* * * *

The first of a series of studies on new and noteworthy South American plants by Albert C. Smith, of The New York Botanical Garden, has appeared in the *Bulletin of the Torrey Botanical Club* for February, 1931. It covers the flora of Peru and Amazonian Brazil.

* * * *

"Orchids for the Amateur to Grow" is the title of an article in *Horticulture* for October 1, telling of the soil, surroundings, and care required for orchids in a small greenhouse, and naming the most practical varieties for the beginner to attempt.

CAROL H. WOODWARD.

THE BARTLETT–NORCROSS GREENLAND EXPEDITION

The schooner *Morrisey,* under the command of Captain Robert ("Bob") Bartlett, carrying The Bartlett-Norcross Greenland Expedition of 1931, returned to New York in September, bringing important botanical material to The New York Botanical Garden.

Before leaving in the spring, Mr. Norcross and Captain Bartlett visited the Garden and both became interested in securing material for this institution. The expedition was accordingly outfitted by the Garden with specially constructed Wardian cases for living plants and with presses, driers, and other material needed for preparing study material in the form of herbarium specimens. Through the interest and courtesy of the Federal Horticultural Board, a special permit was received covering the importation of living plants.

The living collections of the Garden have therefore been enriched by seven Wardian cases full of live plants, representing many interesting types characteristic of the scanty Greenland flora, which will be planted in the Rock Garden this winter. Among them are several of the arctic willows and the arctic heather, *Cassiope tetragona,* which is used by the Eskimos for fuel and is highly commended by Stefansson in his book, "The Friendly Arctic." Others are arctic species of plant types common in our rock gardens, such as *Dryas,* the Everlasting, and Thrift. There is also a little arctic Mouse-ear Chickweed. Some of them will probably adapt themselves to the milder winters of New York. Others will need a lot of special care in order to make them at home.

The herbarium material collected forms a distinctly interesting addition to the reference collection of the Garden, representing as it does all kinds of plants found in flower or in fruit on Clavering Island, Angmagssalik, Cape Storch, Shannon Island, and other places where it was possible to collect botanical material, including also some specimens from Iceland. Mosses and algae were not overlooked, and a number of species in these groups are represented.

NOTES, NEWS, AND COMMENT

Professor Henri Lecomte, for many years curator of the phanerogamic herbarium of the Muséum d'Histoire Naturelle in Paris, retired from his duties on October 1. He is succeeded by Professor Henri Humbert.

The fern collections of The New York Botanical Garden have been enriched by a gift of 200 specimens of New Zealand ferns secured by Mr. Frederick Walker Lincoln, of New York and Greenwich, Connecticut, in New Zealand in about 1880. Many of the specimens are of particular interest and a number of species are represented that were previously not available in the herbarium of the Botanical Garden.

The September number of the *Cactus and Succulent Journal* (Vol. 3, No. 3) shows the beginning of an ambitious enterprise - the reprinting of Volume 1 of the Britton and Rose monograph of "The Cactaceae." This work, already a classic, was issued in four volumes by The Carnegie Institution of Washington, in the years 1919, 1920, 1922, and 1923, in an edition of 750 copies. Volume 1 has long been unobtainable from the publishers and the original stock of Volume 2 has more recently been exhausted. It is the intent to reproduce the volume "exactly as it first appeared," and the publication committee's prospectus quotes a very succinct and effective statement by Professor W. L. Jepson, of the University of California, in support of this purpose. New information, comments, and changes will be printed on two pages of each issue of the *Cactus and Succulent Journal* and these pages will be brought together for a supplement to the reprinted Volume 1. We are informed that the Carnegie Institution has turned over to the committee more than "$58,000 worth of pictures, cuts, illustrations, photographs, and manuscript." The present reprinting comprises the first sixteen pages, including frontispiece, title page, contents, lists of illustrations, and the first four pages of the introduction. Typography, paper, and press work are excellent.

Meteorology for October. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 83° F. on the 3rd; *89° on the 8th*; 76° on the 15th; 75° on the 25th; and 72° on the 28th. The minimum temperatures recorded were: 42° on the 12th; *37° on the 13th and the 19th*; 42° on the 22nd; and 40° on the 31st. The total precipitation for the month was 2.75 inches.

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Some of the leading features of The New York Botanical Garden are:

Four hundred acres of beautifully diversified land in the northern part of the City of New York, through which flows the Bronx River. A native hemlock forest is one of the features of the tract.

Plantations of thousands of native and introduced trees, shrubs, and flowering plants.

Gardens, including a beautiful rose garden, a rock garden of rock-loving plants, and fern and herbaceous gardens.

Greenhouses, containing thousands of interesting plants from America and foreign countries.

Flower shows throughout the year—in the spring, summer, and autumn displays of narcissi, daffodils, tulips, lilacs, irises, peonies, roses, lilies, water-lilies, gladioli, dahlias, and chrysanthemums; in the winter displays of greenhouse-blooming plants.

A museum, containing exhibits of fossil plants, existing plant families, local plants occurring within one hundred miles of the City of New York, and the economic uses of plants.

An herbarium, comprising more than one million specimens of American and foreign species.

Exploration in different parts of the United States, the West Indies, Central and South America, for the study and collection of the characteristic flora.

Scientific research in laboratories and in the field into the diversified problems of plant life.

A library of botanical literature, comprising more than 41,000 books and numerous pamphlets.

Public lectures on a great variety of botanical topics, continuing throughout the year.

Publications on botanical subjects, partly of technical, scientific and partly of popular, interest.

The education of school children and the public through the above features and the giving of free information on botanical, horticultural, and forestal subjects.

The Garden is dependent upon an annual appropriation by the City of New York, private benefactions and membership fees. It possesses now nearly two thousand members, and applications for membership are always welcome. The classes of membership are:

Benefactor	single contribution	$25,000
Patron	single contribution	5,000
Fellow for Life	single contribution	1,000
Member for Life	single contribution	250
Fellowship Member	annual fee	100
Sustaining Member	annual fee	25
Annual Member	annual fee	10

Contributions to the Garden may be deducted from taxable incomes.

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I hereby bequeath to The New York Botanical Garden incorporated under the Laws of New York, Chapter 285 of 1891, the sum of ———.

Conditional bequests may be made with income payable to donor or any designated beneficiary during his or her lifetime.

All requests for further information should be sent to

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JOHN K. SMALL

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SARAH V. COOMBS

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PUBLIC LECTURES AND DEMONSTRATIONS, DECEMBER, JANUARY, AND FEBRUARY, 1931-32

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VANISHING IRIS

Iris is without much doubt an ancient type of vegetation. Fossil specimens, fragments of narrow, parallel-veined leaves from as far back as the Upper Cretaceous strata, have been referred to *Iris* by paleobotanists. Such specimens have been found in collections from deposits as far north as the Arctic regions.

The specialized structure of the flower, too, indicates a long history of morphological development. What the pre glacial development and distribution of the species of *Iris* were can never be known. But the present geographic distribution of the species in the regions once either covered by or exempt from the ice-sheets is instructive and interesting.

The cases of minor import where a few species are restricted to one or more continents, though not very helpful in regard to the present geographic distribution, may be mentioned as follows: One species in Asia and North America; two species in Africa; three species in Europe and Africa; three species in Europe, Asia, and Africa; seven species in Europe and Asia. On the other hand, the relative number of species now confined to Asia, North America, and Europe seems to indicate something very definite about the ancient history of *Iris*.

Today *Iris* is circumboreal and circumtemperate, extending in latitude from near the Arctic Circle to near the northern Tropic, but with very unequal continental distribution. If we are correct in assuming that in pre-glacial times it was numerically quite evenly distributed around the Northern Hemisphere, it is interesting to consider the present distribution in relation to distribution of ice sheets in the glacial periods. Referring to the present specific continental distribution, in round numbers, we find a *hundred* species confined to Asia, *fifteen* species confined to Europe,

and *sixty* (counting the present known undescribed Mississippi Delta species) in North America. Reference to a map charting the extent of the ice-sheets in the glacial periods will show that Asia was practically exempt from the ice sheets that devastated great parts of the other two continents. North America had more unglaciated area than had Europe, and in addition this undevastated land lay nearer the warm or tropical regions. The present discrepancy in the number of species on these continents may be the result of the freedom of the whole Asiatic area from the ice-

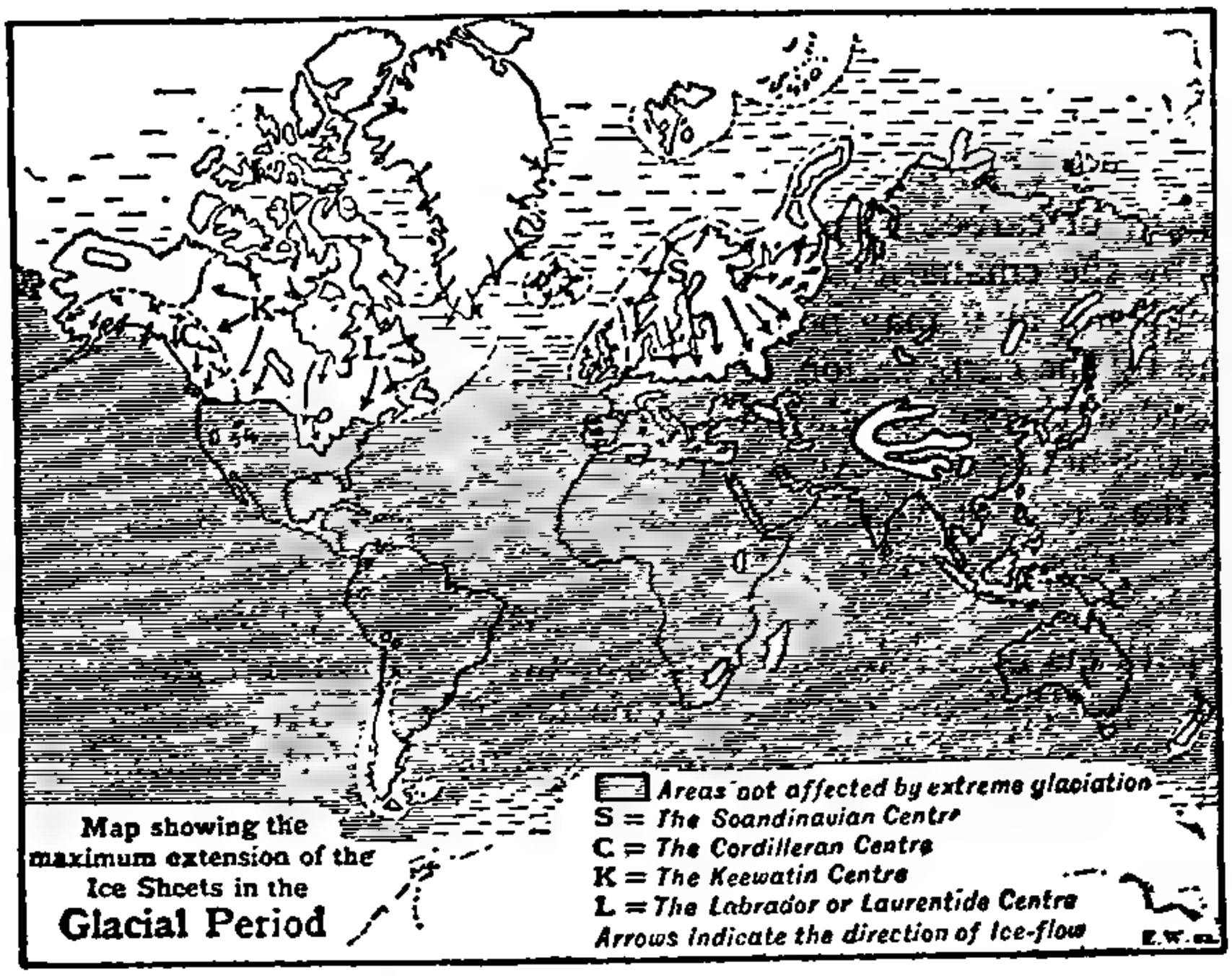
K
L
S
C
Areas not affected by extreme glaciation
S = The Scandinavian Centre
C = The Cordilleran Centre
K = The Keewatin Centre
L = The Labrador or Laurentide Centre
Arrows indicate the direction of Ice-flow
Map showing the maximum extension of the Ice Sheets in the
Glacial Period

FIGURE 1. Map showing the extent of glaciation—unshaded areas at top —during the ice-ages. Today iris occupies the regions shaded and unshaded from about the middle of the map, above the captions, up to the Arctic Circle.—(Map and caption from the Encyclopaedia Britannica, Ed. 11. By permission.)

sheet, on the one hand, and the relatively larger and smaller areas exempt in the case of the other two continents, on the other hand. The rigors of the ice-ages were great, and *Iris* may not have had the vitality to re-assert itself.

The genus *Iris*, both as regards species and groups of species, is very unevenly distributed geographically in eastern North Amer-

ica. The same irregularity also is true of the altitudinal distribution.[1]

In the extreme northeast the genus first appears as the species *Iris Hookeri.* The range of this species extends from Labrador and Newfoundland to the coast of Maine. Its largely maritime habitats are only slowly eroded and there is little danger of urban developments invading its favorite haunts.

Then *Iris versicolor* in the east and *I. Shrevei* in the west appear. They have wide geographic distributions and to a large extent they inhabit places least likely to be disturbed by agricultural and urban developments. Likewise, the habitats of *Iris prismatica,* which occur in the Atlantic Coastal Plain, the Piedmont, and the lower parts of the Blue Ridge provinces are such as are unlikely to be destroyed by urban and agricultural progress. However, although much growth and many colonies of the three species mentioned in this paragraph have been exterminated, there need be no fear of any serious depletion of their ranks for a long time to come.

Another widely distributed species, *Iris virginica,* which replaces *I. versicolor* in the south, occurs in all the southeastern States east of the Mississippi River. It inhabits the three plant provinces mentioned above, and some of those lying west of the Blue Ridge. Its habitats too are in places least likely to be disturbed by the advance of civilization, as well as being in a region of relatively sparse population.

Southeastward the several additional irises each have a more restricted geographic distribution and but little altitudinal range. Six species in addition to *I. virginica* are concerned in this area. In the order of the extent of their geographic ranges, from the most extensive down, they are *Iris tripetala, I. hexagona, I. savannarum, I. Albispiritus, I. rivularis,* and *I. Kimballiae.* Among these, *Iris savannarum* is the most abundant quantitatively in its range, growing in colonies often many acres in extent. *Iris tripetala* and *I. hexagona* occur in smaller colonies throughout their geographic ranges, which are nearly similar. *Iris Albispiritus, I. rivularis,* and *I. Kimballiae* occur in smaller colonies within their more restricted geographic ranges. However, grow-

[1] See "Altitudinal Distribution of Eastern American Iris," Jour. N. Y. Bot. Gard. **32**: 49–66. 1931.

ing in regions of sparse population and relatively slow political development, an existence for the future is indicated. Their partial or total extermination is possible only by the sinking of the Coastal Plain a few feet, a catastrophe which their ancestral relatives seem to have experienced in the relatively recent geologic past.

All things considered, the irises of the Blue Ridge, the Piedmont, and the Atlantic and eastern Gulf Coastal Plains are in little danger of extermination for a long time to come, except locally. Those occupying wide geographic ranges, even in regions of rapid political developments, are safe through their abundance and more or less out of-the-way habitats, while those of more restricted geographic ranges occupy regions of less rapid invasions of civilization and habitats of slow erosion, whether these be the rocky shores of the northeast or the sandy flats of the southeast.

Although there has been comparatively little destruction among the irises thus far considered, either specifically or quantitatively, through artificial methods, there may have been in the more recent geologic past considerable natural destruction. Had there been no destruction, all the species mentioned above should have geo graphic ranges extending from the mountains, their one-time refuge, to the sea-coast, and thus altitudinal ranges also. But this is not the case.

Only *Iris versicolor, I. virginica,* and *I. prismatica* have maintained a foothold in the three plant provinces, the Blue Ridge, the Piedmont, and the Coastal Plain. The ancestors or rearguard of the other species succumbed in the mountains or in the Piedmont, or in both, as the species migrated into the Coastal Plain, where we find their descendants as we know them today.

Although comparatively little actual destruction among the irises in the regions extending from the Blue Ridge eastward and southward has taken place before the eyes of man, the fate of another iris center, minor in regard to area, but major in regard to biologic and specific developments, tells quite a different story.

In the first iris area described on the preceding pages (the northeast), the topography of the region as regards the natural iris developments and political developments may be considered "fifty-fifty," so to speak. In the second area (the southeast), the natural topography seems to be ninety per cent in favor of

FIGURE 2. A clump of white-flowered iris (*I. elephantina*) in the colony where it was discovered in 1926. The locality was a swamp about fifteen miles east of New Orleans. The colony was totally destroyed within two years after it was discovered.

iris and ten per cent in favor of civilization inroads which may mean destruction.

In an article under the caption "Salvaging the Native American Irises,"[2] in which our positive activities in the iris fields during the spring of 1931 are recorded, reference was made to the various causes leading to the destruction of large and small colonies, and perhaps species and varieties of native irises. In these notes an estimate was given to the effect that at that time about eighty per cent of the iris fields of the lower Mississippi Delta had been wiped out during the past half century!

A letter recently received from R. A. Bazet, Clerk of Court, Parish of Terrebonne, a naturalist and associate in our iris studies, contains the following important and interesting paragraphs. These points were referred to in a general way in the article entitled "Salvaging the Native American Irises."[2]

"I. That innumerable iris fields have been destroyed by the entrance of salt water by means of the opening of artificial waterways to obtain more direct water routes to the Gulf is evident. I know this to be a fact in several instances, two of which may be mentioned. One conspicuous case resulted from the opening of the Pointe au Barré Canal in the southern part of Terrebonne Parish, where formerly great iris fields (consisting almost exclusively of *Iris giganticaerulea*) existed. These have been wiped out by the almost constant presence of salt water. Later on, the excavation of the Minor Canal from Bayou Black to Lake Ducad in Terrebonne Parish had the same effect on the iris growth in certain parts of the low marsh-land through which this canal was cut.

"II. The drainage of swamps and prairies results in a two-fold program of destruction of iris growth. First, the drainage itself creates a condition which, in periods of drought particularly, would not be considered ideal for a moisture-loving plant; and secondly, the areas have been rendered susceptible to repeated brush and forest fires which have taken a heavy toll. I have seen many cases where the humus had burned to a depth of two or three feet, destroying not only the smaller vegetation, but forest trees as well. It is not uncommon to see large trees with roots exposed to the extent of several feet as a result of the burning of the humus deposit upon which they stand. No iris could exist under such conditions.

"III. With reference to the destruction of iris by the dredging of bayous, I might add that by the older method of perform-

[2] See Jour. N. Y. Bot. Gard. 32: 175–184. 1931.

ing this work the dipper dredge was used, the dredged material being merely thrown upon the bank of the stream, forming a levee, beneath which was buried not only the plant forms which existed along the water's edge, but also such as may have existed in the stream itself. The modern method, in my opinion, is even more destructive in that not only is the growth in the stream destroyed, but large areas in the swamps, beyond the natural levee of the bayou, are covered to a uniform depth of several feet of soil in some cases. I have seen the discharge pipe of a suction dredge extend over a mile in order to reach some low spot in the swamp which the owner had designated as a dumping ground in his permit to the Federal Government for the privilege of filling on his property. This dredging is constantly going on in one place or another because all of our navigable streams (bayous) have to be dredged at least once every ten years in order to maintain the required depth."

A recent letter of George Thomas, of the New Orleans Parking Commission, whose observations on the irises about that city extend over nearly half a century, says:

"During the past twenty-five years, I have witnessed the most frightful destruction amongst the irises within the city limits of New Orleans and adjoining parishes, even worse than that of the Frenchmen Street location. At the junction of Washington and Carrollton Avenues, there was a patch of several acres, which when in bloom appeared to be a solid mass of iris; today not one remains. At the site of Newcomb College there was a fine stand of *Iris fulva*. This has disappeared entirely. Suburban Acres on the way to Kenner at one time was a fine hunting ground for the *vinicolor* types, but very few can be found there now, and the natural growth of the city, with its paved streets and subsurfaced drainage replacing mud streets with open ditches, of necessity destroys many fine colonies of various colors."

During further studies in the Louisiana iris fields, carried on in the first two weeks of August, 1931, with less than three months intervening between the observations recorded in the article referred to above, the progress of further destruction was quite evident.

The field-work referred to in this note was carried out mainly for the collection of miscellaneous iris seeds and the rootstocks of several species of *Iris* for study and distribution.

Conditions found in the iris fields were quite different from those that obtained there at the same time last year, and the har-

vest of iris seeds was not as extensive, both as regards quantity and kinds. These discrepancies were due apparently both to lack of pollination in some cases and local adverse weather conditions that prevailed in the spring and summer.

The relation between meteorologic conditions and locality resulted in a more uneven maturity of capsules than obtained there during the corresponding season last year.

This quest for seeds led us to nearly all the localities in the lower Mississippi Delta, south of Lake Pontchartrain and adjacent territory covered during our activities in the preceding spring. However, we were able to compare the changes that had taken place during the short periods that had elapsed between our periods of field-work. Two conspicuous examples may be recorded:

One of the two now remaining exceptionally fertile and spectacular iris fields in and near New Orleans lies in the Gentilly section of the city. This area is the remaining damp spot of the one-time Bayou Sauvage. Here is where our attention was first attracted to these Delta iris fields (in 1925) and where year after year new species, new forms, and new hybrids have yielded recruits to our collections through our field-work. On the other hand, during the past half-decade alone fully seventy-five per cent of the iris growth that existed there in 1925 has been completely destroyed, chiefly through draining, filling in of low places, and building operations! Aside from minor areas, one locality alone, of about ten acres, where many choice kinds of iris grew in abundance up to last spring, has been filled with soil, leveled off, and the iris growth wiped out!

The other field was described in the notes referred to above.[3] These were in reference to the Bayou Lafourche. Here, for miles between Golden Meadows and Cut-off all the irises on the bayou banks and in the ditches between the roadway and the farms had been destroyed through the building of a new road within the past two months (June and July, 1931). Referring to this region Mr. Bazet writes that:

"The building of levees along the Mississippi and certain of its tributaries, and the damming of the Bayou Lafourche at Donaldsonville, with a tributary thereto —even to the extent of rendering

[3] See Jour. N. Y. Bot. Gard. 32: 177. 1931.

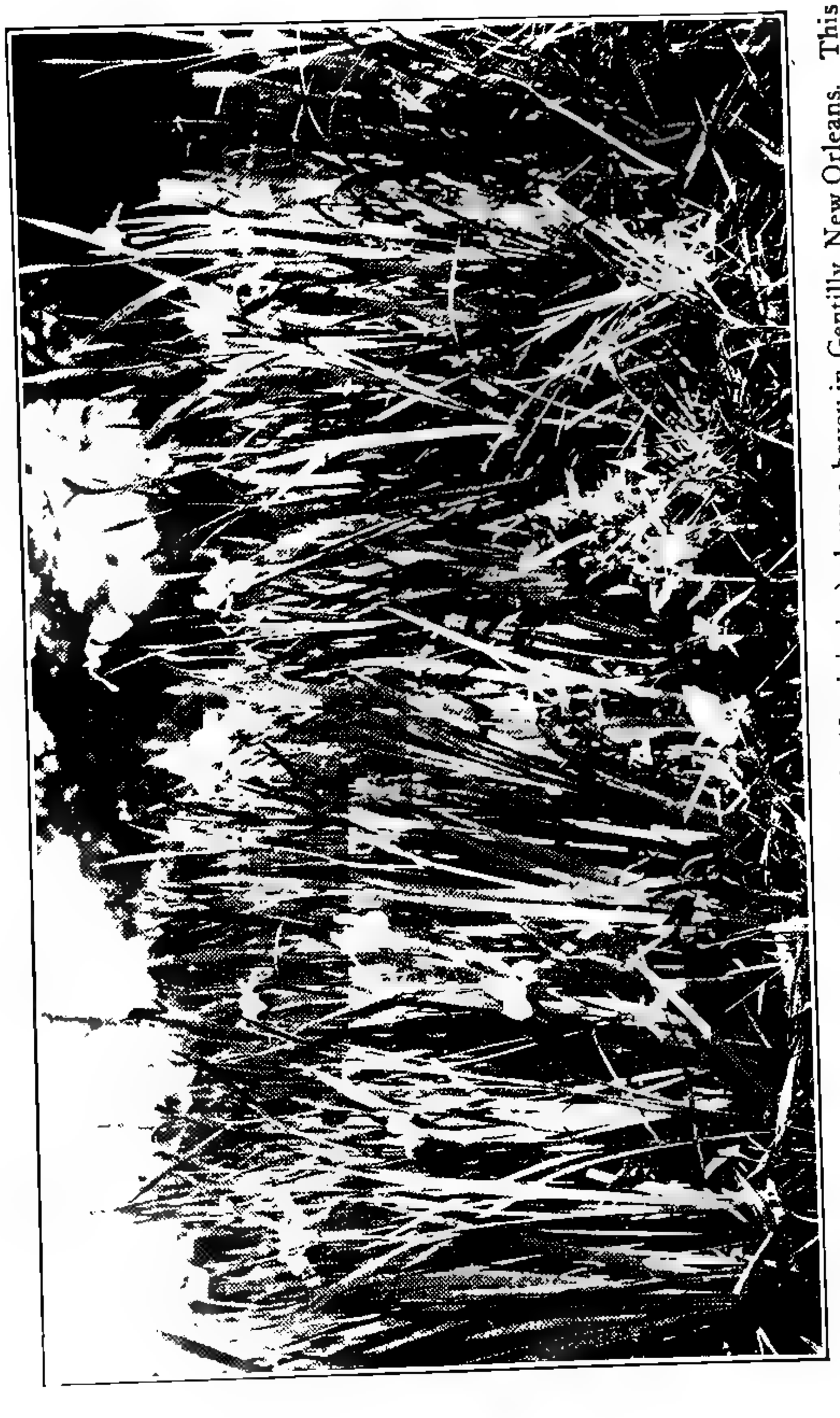

FIGURE 3. A colony of reddish-flowered iris (*I. vinicolor*) along a bayou in Gentilly, New Orleans. This colony and many associated with it were destroyed within the past two years.

their former beds susceptible to cultivation—have to an indeterminable extent been responsible for the vanishment of some of our greatest iris fields."

These are examples of destruction taking place before one's very eyes, so to speak. An example of an earlier case of devastation may be of interest. This is the case of the Bayou Chacahoula in Terrebonne Parish. Evidence indicates that this was a very fertile iris field years ago. It was not a deep bayou, so drainage and agriculture, through its gradually leveling methods, mainly for the growing of sugar-cane and corn, has obliterated the former course of the bayou as far as prominent topography is concerned, but its former course may be followed by the black soil that was deposited in its channel through the ages.

Along its course, here and there, may be found a depression in a field or a ditch where a road follows closely its former course. In these damp depressions exist the remnants of the former apparently rich iris fields. Here, within a short distance, may be found *Iris violipurpurea, I. chrysaeola,* a form of *I. vinicolor,* a new pink iris, and several new species of red-flowered irises. *Iris fulva,* too, in many forms and in great quantities, is a conspicuous feature in the shallow ditches. Between Raceland and Luling only recently has the type locality of *Iris miraculosa* been buried under a mass of soil ten to fifteen feet deep, as a result of the building of a new railroad embankment.

Returning to within the city limits of New Orleans, the present condition of the well-known Frenchmen Street iris fields attracts one's attention. The marsh along which and through which Frenchmen Street was built was a celebrated iris field, for many years a favorite place for the citizens interested in iris to observe and gather specimens or bouquets. Manufacturing plants finally began to use the marsh as a dumping ground for refuse, and today most of the former iris growth has been buried, and only a few isolated patches of the plants of the several species that once thrived there in countless numbers remain in the landscape.

Referring back to Gentilly, we may confidently prophesy that the destruction of the iris fields of the remnants of the Bayou Sauvage which lies in this urban and suburban part of New Orleans will be more complete than those of the Bayou Chacahoula, for drainage and building operations are even more destructive to plant life than drainage and agriculture!

In the course of the progress of the local civilization in southern Louisiana, the numerous bayous, an outstanding feature of the landscape, are either drained and filled or dredged and thus deepened into narrow waterways. In the first case the iris ground is buried in the bayou channel, in the other it is buried by the "fill" that is dredged out of the channel. The question which naturally presents itself is this: What is the future of this most wonderful local natural iris development to be?

There is a nursery plantation of the species at The New York Botanical Garden. There are minor plantations on the reservations of Colonel and Mrs. Robins on Chinsegut Hill near Brooksville, Florida; of Mr. Henry Lockhart, Jr., on the eastern shore in Maryland; of Mr. Clarence Lewis, at Skyland Farms, near Mahwah, New Jersey; and of Mr. Henry W. de Forest at Cold Spring Harbor, New York. Still smaller plantations are located in many private reservations in other states. Specimens are now growing in England, in France, in Asia, in Australia, and in other parts of the Old World. Thus a beginning toward the preservation of the Mississippi Delta irises, for both botanical investigation and horticultural development, has been made.

The past destruction and present lack of interest in preserving our native irises can be considered only with regret. Will the future show any different attitude in regard to them that is, those which may have survived the past, present, and apparently to be continued devastation? Will any effort or plan to preserve these irises other than those indicated in a preceding paragraph be made?

It seems logical that the municipality of New Orleans should become the savior of its native endemic irises. The city limits of New Orleans and the metropolitan region are the biological and almost geographical center of this iris development. The municipality is situated at the headwaters of the bayous that once harbored one of the most spectacular iris developments known. In the proper area or areas in this reservation should be gathered together as complete a representation of the iris growth from within the city limits and the outlying regions, as has survived the wholesale destruction. Immediate action is necessary if these native irises are to be preserved.

Temporary enthusiasm and individual desultory attempts to establish small iris gardens will be futile so far as preserving iris for the future goes. It will be necessary to have concerted action, with the appointment, at least temporarily, of some official in charge of gathering the plants and of developing this iris reservation with the same attitude as should be used in establishing any great public institution.

In this plantation, or plantations, the various species, varieties, and color-forms of these native irises should not be represented by a few plants of each, but the representation should be generous large colonies—a reproduction of the natural growth as it existed or may still exist, consisting of hundreds or thousands of plants.

No growth lends itself more easily to transplanting, and when once established the plantations would care for themselves in an environment which their ancestors occupied before man came on the scene and destroyed what nature had planted and developed through ages.

JOHN K. SMALL.

COLOR PHOTOGRAPHY IN THE GARDEN[1]

The transitory quality of a garden is its greatest charm. Yet who, possessing one, has not at times longed to preserve its beauty? If only the spring sun would not flatten out the daffodils! If the frost would spare the dahlias! Color photography makes possible a record of the seasons, a history of one's own or other gardens, in all the richness of coloring of the flowers themselves.

I am often asked if photographs in color may be made on paper. The answer is yes and no. Fine pictures are made, but there is to date nothing that approaches the ease in accomplishment of the snap-shot in black and white. There are some interesting new processes revealed by recent patents, which will simplify the work: two-color dye-print methods, producing fair results by a single exposure; color-prints on a metal base; a new German

[1] Abstract of an illustrated lecture given at The New York Botanical Garden, Saturday afternoon, September 26, 1931.

process; a new English one, and others, most of them still in the patent-office stage and not yet on the market.

Color-prints may be made by contact with a transparency in certain ways and with some good results, but for an original photograph on paper, Captain Owen Wheeler says in his book on "Colour Photography": "In order to obtain a faithful reproduction of yellows, reds, and blues in the original, three separate negatives must be taken behind filters of the colours to which yellow, red, and blue are complementary." This necessitates a specially made camera, a repeating back, a long holder with three plates or some device to produce the three negatives quickly in succession, without too long an exposure. The prints taken from these negatives must be dyed in the complementary colors, superimposed in exact register and fastened together. It is a long and fussy process with results somewhat uncertain even to an expert, though fine when successful.

The color photography which appeals most to amateurs is the making of transparencies on glass. These may be shown in various ways—as lantern slides like those to be seen today, or framed in a north window, where light but not too much sun will reach them, or viewed in a folding case called a diascope where the plate is reflected in a mirror, this being a very satisfactory way.

There are three well-known processes of making color-transparencies—a French one, the Lumière Autochromes, a German one, employing the Agfa plates, and the Finlay Color Photographic Process, which is English. All three are simple and the results beautiful. Any camera which takes plates may be used.

The method of making Autochromes and Agfas is much alike. In the Autochromes the color element is supplied by starch grains dyed in red, green, and violet-blue, mixed together and placed in a thin layer on the plate, which is then varnished. Next, the sensitive film is laid over it. In the Agfa plates, the color is produced by emulsified solutions of blue, green and red dyes so constituted that the microscopic droplets do not come together. The plate is coated with a thin layer of these mixed but separate solutions, then varnished, and the sensitive film is superimposed. The picture is taken in both cases with the glass side toward the lens, so that the light will strike the color element before acting on the film. A ray-filter must be used "to compensate for the difference

between the actinic and the visual values of the colors in the light," according to the Agfa pamphlet. Exposure is much longer than with an ordinary snapshot and a tripod is necessary. Helpful charts are published by the makers of the plates, and a small mechanical aid known as an actinometer is useful. But above all, experience is the best guide in this all-important matter. Development is done in total darkness or by a dim green light. If the Autochrome plate is first desensitized in a liquid prepared for that purpose, a candle may soon be lighted some distance away to allow development to proceed more easily.

After developing and washing, the plate is placed in a tray containing sulphuric acid and water and bichromate or permanganate of potash and brought into the light, where it " reverses," the reduced silver of the image being dissolved out. Light may still be used, as the plate, now a positive, after brief washing, is redeveloped in the original bath. It is then washed, dried, varnished, and bound up with a piece of clear glass for protection. The finished picture is a brilliant, beautiful transparency in natural colors, with great depth and richness.

The Finlay Color Photographic Process supplies the color element by a separate screen with the three primary colors in a criss-cross pattern. This " taking screen " is placed in the holder with the panchromatic plate, the screen turned toward the lens. A ray-filter is used and exposure takes place which with these plates is claimed to be decidedly shorter than with the two other well-known makes. The plate is developed and fixed. From it a positive is made and fixed, which looks like an ordinary black and white picture, but which under a microscope is seen to have the criss-cross markings of the taking screen. A permanent screen, called the " viewing screen," is held to the light in close register with the plate, the two are moved across each other until, when the color-markings fall together, the colors come out suddenly and excitingly. The plates are then bound together and the work is finished. By this process one may make as many copies as desired from the original negative, also black and white prints.

With the Autochromes and Agfa plates, there is only the one plate. The Finlay colors, however, are not always as brilliant and the process is not so easy. But with all these three methods, wonderfully fine results may be obtained. One may reproduce

tulips, roses, dahlias, in fact, any flowers, in all the gorgeousness of nature. There are a hundred and one ways in which color photography may be used, scientifically, artistically, historically. It is a fascinating hobby.

Eighty lantern slides were shown, mostly gardens and flowers, with a few taken in Sicily to suggest what one may do when traveling.

SARAH V. COOMBS.

PHOTOSTAT SERVICE AT THE NEW YORK BOTANICAL GARDEN

On the basis of a special grant from the Carnegie Corporation of New York to The New York Botanical Garden, this institution has purchased and installed a modern photostat, which is now in operation. Our request to the Carnegie Corporation for funds to finance this important accession was based on the desirability of making available to those botanists and botanical institutions in a position to take advantage of the opportunity, the great wealth of botanical information available in the particularly rich library of The New York Botanical Garden. The photostat is to be operated on a self sustaining basis, the charge for prints being placed at a figure that is estimated to cover the cost of operations, material, and replacements.

The maximum size of prints that can be supplied from the photostat at The New York Botanical Garden is 14 x 18 inches, so that reproductions from folio volumes will of necessity have to be reduced. Negatives (white on black) and positives (black on white) can be supplied as desired, but the cost of the latter will be twice that of the former, as the positive has to be made from a negative print. Normally, negatives, that is. reproduction of white on black, will suffice for all ordinary purposes. With the use of a color screen excellent reproductions of colored plates and illustrations can be supplied in black and white.

It is expected that this service will prove to be of distinct value to research men in the botanical field, particularly those working in the smaller institutions, where complete libraries are not avail-

able. It very frequently happens that a description, a discussion, or an illustration published in some rare volume is essential to the solution of some particular problem. Through the photostat exact reproductions of any printed page or illustration can now be supplied.

The library of The New York Botanical Garden is a very rich assemblage of botanical literature, containing as it does in excess of 42,000 bound volumes on botany and allied subjects, with an even greater number of pamphlets. It is particularly rich in the older botanical literature of all countries, in rare books, and in sets of periodicals, especially in the field of taxonomy, but other fields of botanical publication are well represented. Some of the publications available here are not to be found in other libraries in America, while of others only very few copies are available in the United States. This is particularly true in reference to works issued shortly after the invention of printing, and for the larger, more modern expensive volumes, many of which were issued in very limited editions. Some of these volumes are so rare that under no circumstances will an institution, fortunate in the possession of them, permit their removal from its library. Under ordinary conditions the individual wishing to consult such a publication must journey to the nearest institution possessing the volume to which he wishes to refer; the photostat will enable him to secure the data he needs at a nominal cost without the time and expense involved in making a special trip. Fortunately, no copyright is involved for the great mass of botanical literature, for photostat reproductions from copyrighted works can be made only after the copyright has expired.

The New York Botanical Garden is now in a position to supply photostat reproductions on order from institutions and individuals. In placing orders individuals are requested to supply full and complete bibliographic data covering each order to guide us in the proper selection of the work desired, and to guard against possible errors. Rates for photostat work will be supplied on request.

E. D. Merrill.

SPECIAL COURSES IN BOTANY AND GARDENING FOR MEMBERS

The three popular courses in botany and gardening offered for the first time last year and continued this year have found such favor that there has been a demand from the garden clubs for other special courses. These have been made essentially courses for members of The New York Botanical Garden, each person taking one being either already a member or taking out a membership in connection with the course, that is, ten dollars covers the course and membership for one year.

The Scarsdale Garden Club was the first one to undertake a special course of this sort and their members, to the number of twenty-one, are now coming to the Garden every Tuesday morning for special instruction and practical gardening. They have already taken up Rose Culture, Disease and Insect Control, Bulb Culture under Mrs. Wheeler H. Peckham; and Mrs. H. E. Manville very kindly invited the class to visit her garden and greenhouses at Pleasantville for the session on Conservatory and Sunroom Plants. Her head gardener, Mr. T. H. Everett, gave the talk and instruction. Mrs. Manville arranged very pleasantly for the accommodation of the members, the assembled lecture being in the interesting and picturesque log cabin set amid forests of trees and shrubbery. Her beautifully maintained greenhouses proved to be fully stocked with fine specimen plants. Visits were also made to the rock garden and to the sunken garden of Mrs. Manville, both of which proved to be interesting, both for their artistic beauty and for their collection of unusual plants. The rock garden in particular was a surprise, because it showed such a quantity of bloom late in the season on the first of November. The session on Flowering Shrubs is at the Boyce Thompson Institute for Plant Research, where the Director, Dr. William Crocker, has arranged to have the members shown the research work and have Mr. Beale give the instruction in the culture and tending of shrubs in the extensive planting of the Boyce Thompson Arboretum. The remaining five sessions, ending December 15, will be at The New York Botanical Garden, the work being given by the members of the Garden staff.

The Greenwich Garden Club is planning for a similar special course of studies at the Botanical Garden and opportunity is

given for other members of the Botanical Garden, either as individuals or as organized groups, to take advantage of the facilities of the Garden for practical instruction.

FORMAN T. MCLEAN,
Supervisor of Public Education.

PUBLIC LECTURES AND DEMONSTRATIONS, DECEMBER, JANUARY, AND FEBRUARY, 1931–32

Free lectures and demonstrations will be given in the Central Display Greenhouse, Conservatory Range 2, on Saturday afternoons at 3:30 P. M., as follows:

Dec. 5. "Flowering Bulbs," Mrs. Wheeler H. Peckham, Honorary Curator of Iris and Narcissus Collections.

Dec. 12. "Broad leaved Evergreens," Mr. Henry Hicks, Nurseryman and Rhododendron Specialist.

Dec. 19. "Summer-flowering Bulbs and Lilies," Dr. Forman T. McLean, Supervisor of Public Education, and Dr. A. B. Stout, Director of Laboratories.

Jan. 9. "Outdoor and Indoor Ferns," Dr. Ralph C. Benedict, Brooklyn Botanic Garden.

Jan. 16. "Planting and Growing Conifers," Mr. Alexander Michie, Nursery Manager for T. A. Havemeyer.

Jan. 23. "Roses," Dr. B. O. Dodge, Plant Pathologist.

Jan. 30. "Begonias," Mr. T. H. Everett, Head Gardener at the Manville Estate, Pleasantville.

Feb. 6. "Flowering Shrubs," Mr. J. H. Beale, Boyce Thompson Institute, Yonkers.

Feb. 13. "Annuals," Mr. Kenneth R. Boynton, Head Gardener.

Feb. 20. "Water Lilies and Their Care," Mr. H. W. Becker, Foreman of Greenhouses.

Feb. 27. "Dahlias and Chrysanthemums," Dr. M. A. Howe, Assistant Director, and Mr. Kenneth R. Boynton, Head Gardener.

HOW TO REACH THE CONSERVATORY

Conservatory Range 2 is situated at the eastern side of the Botanical Garden, north of the Allerton Avenue Entrance. It is

most conveniently reached from the Allerton Avenue Station of the White Plains extension of the Subway from East 180th Street. Visitors coming by train to the Botanical Garden Station should inquire at the Museum Building.

In connection with the free lectures, announced above, there is also a course of practical work and instruction, beginning at 2 P. M. and continuing until 3:30. This course is open to annual and other members of the Garden without charge. For those who are not already members, a charge of ten dollars is made, which enrolls them as annual members and thus entitles them to the course of study. This type of practical instruction has proved particularly popular with home gardeners who seem to prefer to learn about gardening methods by doing rather than depending on books alone for information.

NOTES, NEWS, AND COMMENT

Dr. Fred J. Seaver, Curator of the collections of fungi of The New York Botanical Garden and editor of *Mycologia,* received on October 24 the honorary degree of Doctor of Science from Morningside College, Sioux City, Iowa, from which he was graduated with the degree of B.S. in 1902. The occasion was t' e inauguration of a new president of the college. Among the other distinguished alumni who were honored at the same time was Dr. Alexander G. Ruthven, zoölogist, now President of the University of Michigan.

The Royal Botanic Society Gardens, maintained for ninety-two years in Regents Park, London, by the Royal Botanic Society, were closed in October and most of the plants were sold. The publication of news items to this effect in the United States has led occasionally to the wholly erroneous belief that the more widely famous Royal Botanic Gardens at Kew were being closed.

The general and local collections of herbarium specimens of The New York Botanical Garden have been distinctly enriched by extensive gifts of critically selected, well-prepared, and authentically named herbarium specimens presented by Dr. Charles E. Moldenke, of Plainfield, N. J., and his son, Harold Moldenke, the latter a registered student at the Garden. These important

gifts exceed 2200 numbers. In addition to the botanical material, Dr. Charles E. Moldenke has recently presented to the library about 80 volumes pertaining to botany and horticulture.

Mr. Kenneth K. Mackenzie, a member of the Board of Managers of The New York Botanical Garden, has presented his private herbarium to the Garden. It is estimated to contain approximately 40,000 specimens and it includes a large quantity of most important material, largely from North America, but representing also various other regions. This is the largest single accession received by the Garden in recent years. It is supplementary to Mr. Mackenzie's previous gift of his local material and undistributed duplicates.

Mr. Raymond V V. Miller, brother of the late Waldron DeWitt Miller, Associate Curator of Birds, American Museum of Natural History, has presented to The New York Botanical Garden the latter's private herbarium, consisting largely of plants collected in New Jersey. The collection contains between 2500 and 3000 specimens and forms an important accession to the local herbarium of the Garden, *i.e.*, these plants growing within 100 miles of the City of New York. This is the fourth important accession received for the local herbarium during the past year or so, the others being the Ferguson herbarium of Long Island plants, the Mackenzie herbarium of local plants particularly rich in New Jersey plants, and the important series of plants from New Jersey collected and presented by Harold Moldenke, as mentioned above. With the distribution of the very extensive Bicknell herbarium, received some years ago, the local herbarium has been more than doubled in size, and consequently in importance within the last two years.

Meteorology for November. The maximum temperatures recorded at The New York Botanical Garden for each week or part of a week were: 65° on the 4th; 75° on the 10th and the 13th; 74° on the 22nd; and *76° on the 23rd.* The minimum temperatures recorded were: *26° on the 8th;* 42° on the 14th; 47° on the 20th; and 28° on the 28th. The first killing frost was on the morning of the 7th; the first snow of the season (⅛ of an inch) fell on the 27th. The total precipitation for the month was .262 inches, including the snow fall counted as .012 inches.

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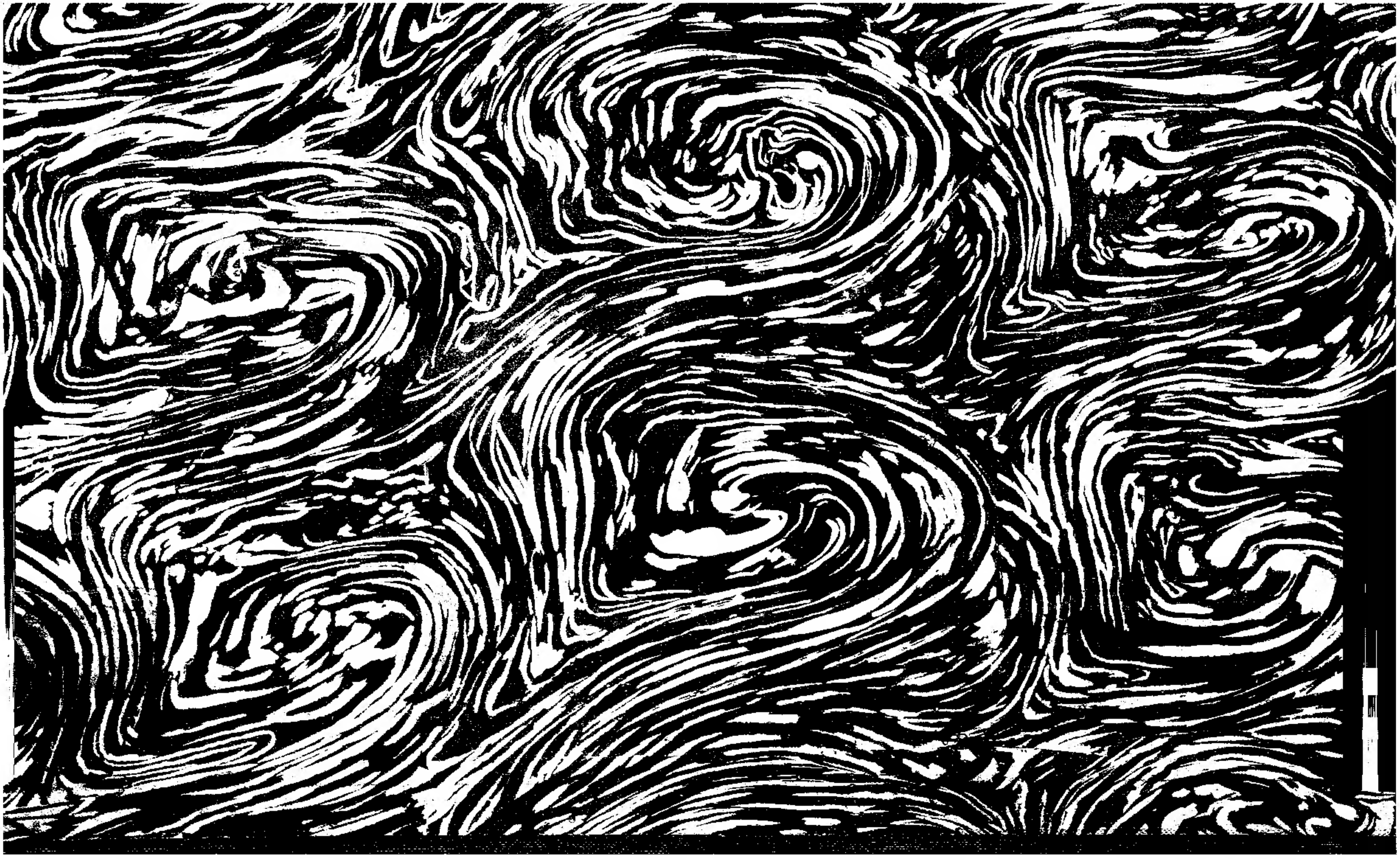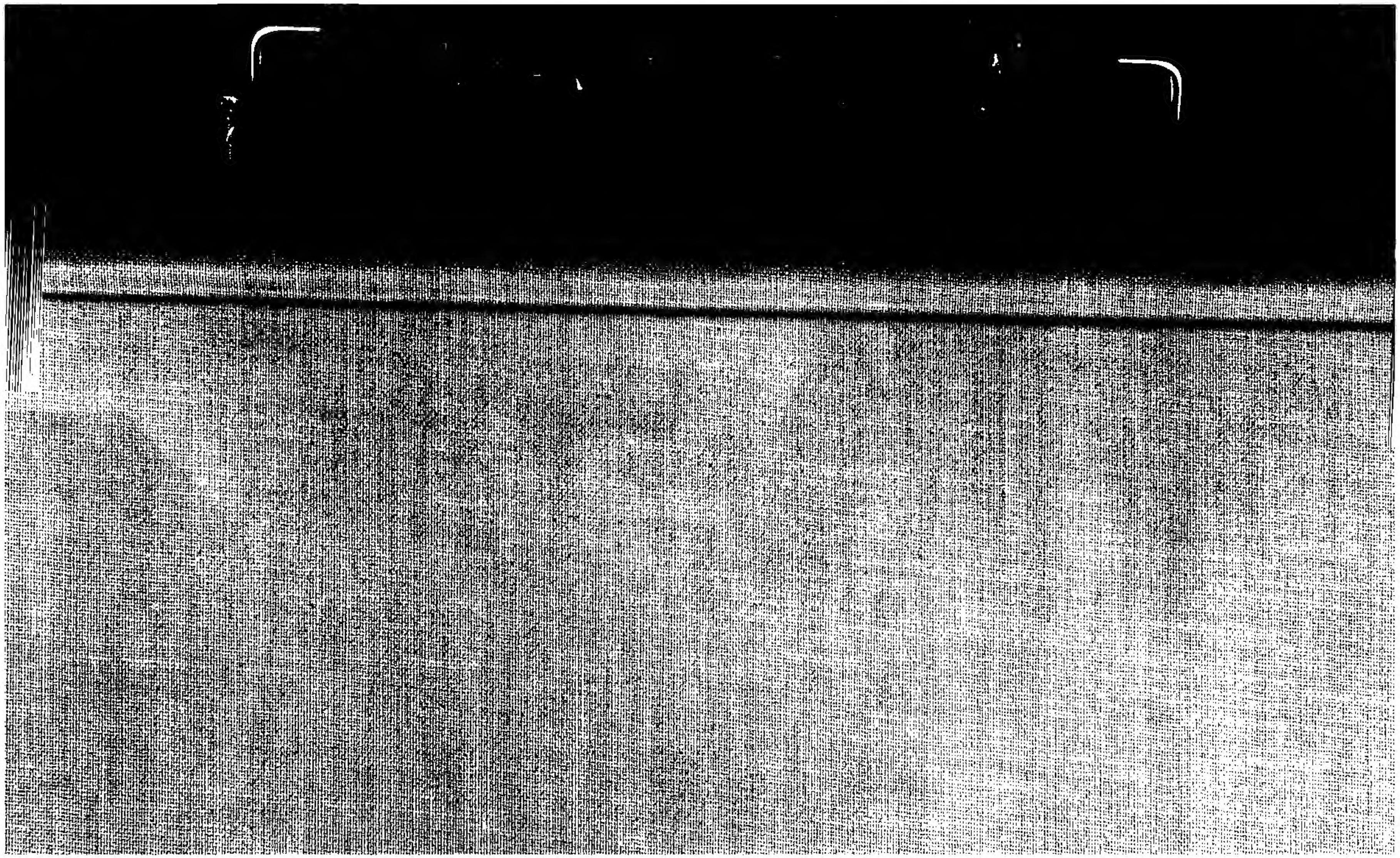
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